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TECHNICAL REPORT 4980

INTERGRATED PROJECTILE SYSTEMS SYNTHESIS MODEL (IPSSM)

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AUGUST 1976

PICATINNY ARSENAL
DOVER, NEW JERSEY

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REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: Technical Report 4980 (14) PA-TR-4980 — 2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): (6) Integrated Projectile Systems Synthesis Model (IPSSM),	5. TYPE OF REPORT & PERIOD COVERED: (9) Interim report
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): (10) L.F. Nichols, D. Lewis	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Picatinny Arsenal, SARPA-ND-C, Dover, New Jersey	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: (12) 241 p.
11. CONTROLLING OFFICE NAME AND ADDRESS: (11)	12. REPORT DATE: Aug[redacted]76
	13. NUMBER OF PAGES: 284
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Computer modeling	Exterior ballistics	Program modules
Projectile design	Aerodynamic properties	Interactive teletype mode
IPSSM	Lethal area effectiveness	Batch mode
Interior ballistics	Trajectory calculations	Weapon system modeling

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A Computer model called IPSSM (Integrated Projectile Systems Synthesis Model) is being developed for use in the preliminary design of large caliber projectiles. Complete capabilities of the interim version of this model are detailed, and instructions are given for users of the program in both the interactive teletype and batch modes. The use of this initial version of IPSSM will determine additional modules to be added as well as refinements in the over-all operation of the system.

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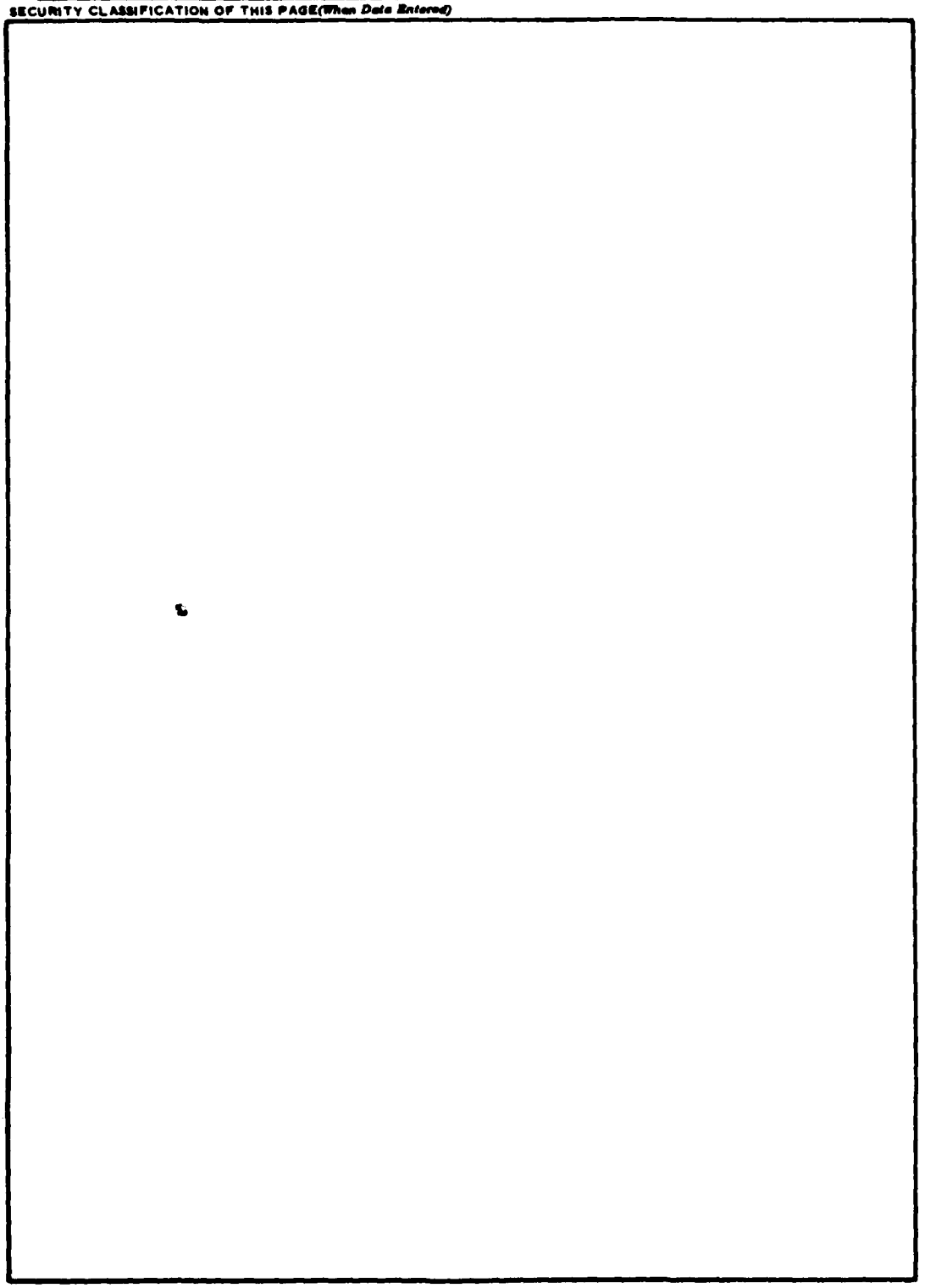

ACKNOWLEDGEMENTS

The original idea and many innovative techniques for this project were conceived by Forrest McMains in a pilot version of the executive program. A special note of thanks is also due to Frank Morehouse, Mike Siegal and Cindy Lou Fancy, each of whom devoted numerous hours incorporating suggested programming improvements into IPSSM, attempting to make IPSSM as uncomplicated as possible for future users of the system. Also to be acknowledged is the invaluable technical programming expertise provided by Ed Loniewski of PAD and the very helpful editorial assistance of Frank Morehouse and John Reformato in preparing this document for publication.

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OBJECTIVES AND APPROACH

The objective of this program is to develop a complete computer model for use in the preliminary design of large caliber projectiles. This model, called IPSSM (Integrated Projectile Systems Synthesis Model), is a set of computer program modules and subroutines integrated in such a manner as to provide a realistic, interactive, computational tool for engineers and designers engaged in the development of preliminary design information for projectiles. The model described in this report includes the capability of performing extensive calculations necessary to formulate projectile designs. Computations include interior and exterior ballistics, static shell property calculations, aerodynamic properties generation, lethal area effectiveness, 6-D trajectory calculations, recoil mechanism design, and sabot design.

The general approach in the complete development of the model calls for the selection and modification of existing computer programs to accomplish specific calculations as well as the identification of programming tasks required to complete the model. The essential ingredient of IPSSM is its common data base and a well coordinated and integrated set of computer programs which are not only extracting information from previously run programs within the system but are also generating specific data for subsequent use by other programs. These programs will either continue or modify the design process or be used for optimization. They are modular in nature so as to facilitate future improvements or replacements of the design programs. Over-all control of the model is accomplished by the user through the executive program.

The objective of this report is to provide an initial user's manual for the IPSSM System currently available. Additional features, updates, and modifications will be accomplished as use is made of this initial version of IPSSM.

BACKGROUND

In May 1970, DARCOM (AMC) initiated a feasibility study directed toward weapon system computer modeling which would provide preliminary design parameters for tactical missile weapon system concepts. After DARCOM (AMC) had presented the concept and preliminary comments of subordinate commands to the CAD-E Council in October 1970, the IWSSM (Integrated Weapon System Synthesis Model) Ad Hoc Working Group of the Council was established to study the concept in more detail. After a six-month effort, the working group concluded that such a system was both feasible and desirable, but initially it should be limited to the construction of a number of computer models, each

addressing a particular military commodity. It was considered too large an undertaking to develop one model that would handle all commodity designs such as guns, projectiles, missiles, aircraft, vehicles, etc.

The recommendation of the IWSSM Working Group was that each command submit a Program Data Sheet outlining a proposed activity directed toward a specific commodity. The Integrated Projectile System Synthesis Model (IPSSM) Program was established at Picatinny Arsenal to address the preliminary design of large caliber projectiles such as artillery and mortar rounds.

The Picatinny IPSSM program was funded as a CAD-E task on 1 April 1972. A substantial initial effort was directed toward a survey of existing computer programs in use at Picatinny and other government agencies which would be suitable for incorporation into the IPSSM System. Major areas of design interest were identified by system engineers,and computer programs within each area were identified. The programs were examined for (1) adequate documentation and technical adaptibility within the design area, and (2) adaptibility of input and output data formats that would be consistent with the over-all requirements of the executive program.

Existing computer programs to determine static and aerodynamic shell properties, perform interior and exterior ballistics calculations, compute lethal areas, do 6-D trajectory calculations, and design recoil mechanisms and sabots were selected. Source listings were obtained and put into update format, and proper operation was verified with test cases. Each of the nine codes (Weight, Spinner, Aerol, Interior Ballistics, Lethal Area, 6-D Trajectory, Recoil Mechanism, Sabot Design and Heppner-Interior Ballistics) has been made operational under both the interactive teletype (TTY) and batch mode to facilitate entry and exit from the executive program. Major effort was devoted to the design and checkout of the preliminary IPSSM executive program. The system has been used on a trial basis and is now ready for general use to determine its adequacy as a design tool.

Several user sessions have been conducted to acquaint engineers and scientists involved in projectile design and evaluation with the operation of the current IPSSM system. These sessions will continue as more personnel become involved. As a result of these initial meetings, several important modifications were made to improve the operational capabilities of the system. For example, an optional abbreviated input format can now be utilized to quicken system response in the TTY mode. Testing of user responses in the TTY interactive mode has also been incorporated to avoid program abort as a result of

trivial user typing errors. In addition, an independent computer program (IPSDATA) has been written to simplify the establishment of initial data base files. Output from this program provides the basis for accurate checking of input data files.

PRESENT STATUS

The present IPSSM System can execute nine applications programs from either batch or teletype (TTY) mode. These programs perform the following computations: (1) Static Properties Calculations, (2) Generation of Aerodynamic Coefficients, (3) Interior Ballistics, (4) Exterior Ballistics, (5) Lethal Area Computations, (6) 6-D Trajectory Calculations, (7) Recoil Mechanism Design, (8) Sabot Design, and (9) Heppner-Interior Ballistics.

In TTY mode, the executive program contains options for examining and modifying common data base information. In both modes the program allows the user to modify the data base variables, to store the modified data base in a new permanent file if desired, and to run linked cases of selected variables to facilitate the execution of parametric analyses. Special abbreviated output can be generated and stored automatically for later examination at the TTY. Options also exist for directing entire input/output for each set of application runs to the user's batch terminal or to the central site. The system is also capable of generating input data in the format required for running the graphics projectile measurement program (PROMS) (Reference 2). Output from PROMS can then be entered into the common data base for subsequent computations within the IPSSM System. Figure 1 illustrates the executive module operation in the batch or TTY mode. Figure 2 shows the input-output interface scheme utilized within IPSSM. Although this chart shows the technique for the exterior ballistic interface, the same system has been applied for all application programs. Figure 3 shows the latest flow diagram for IPSSM. The small boxes between the applications programs represent the input-output interfaces controlled by the executive program. Data analysis and optimization will be incorporated to a much greater extent as directed by future user requirements.

Options have also been installed to allow either the current data base to be automatically updated with the results of the current program or to have a separate and distinct new data base created with the same generated results.

EXECUTIVE MODULE OPERATION (IPSSM)

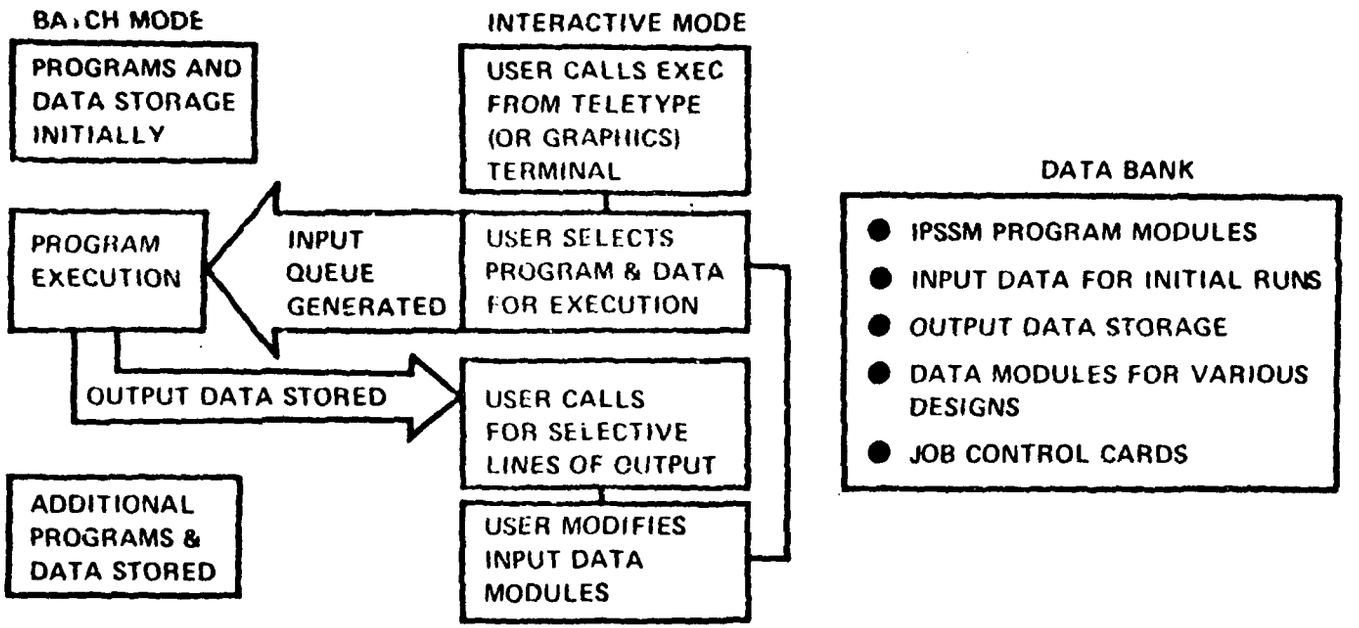
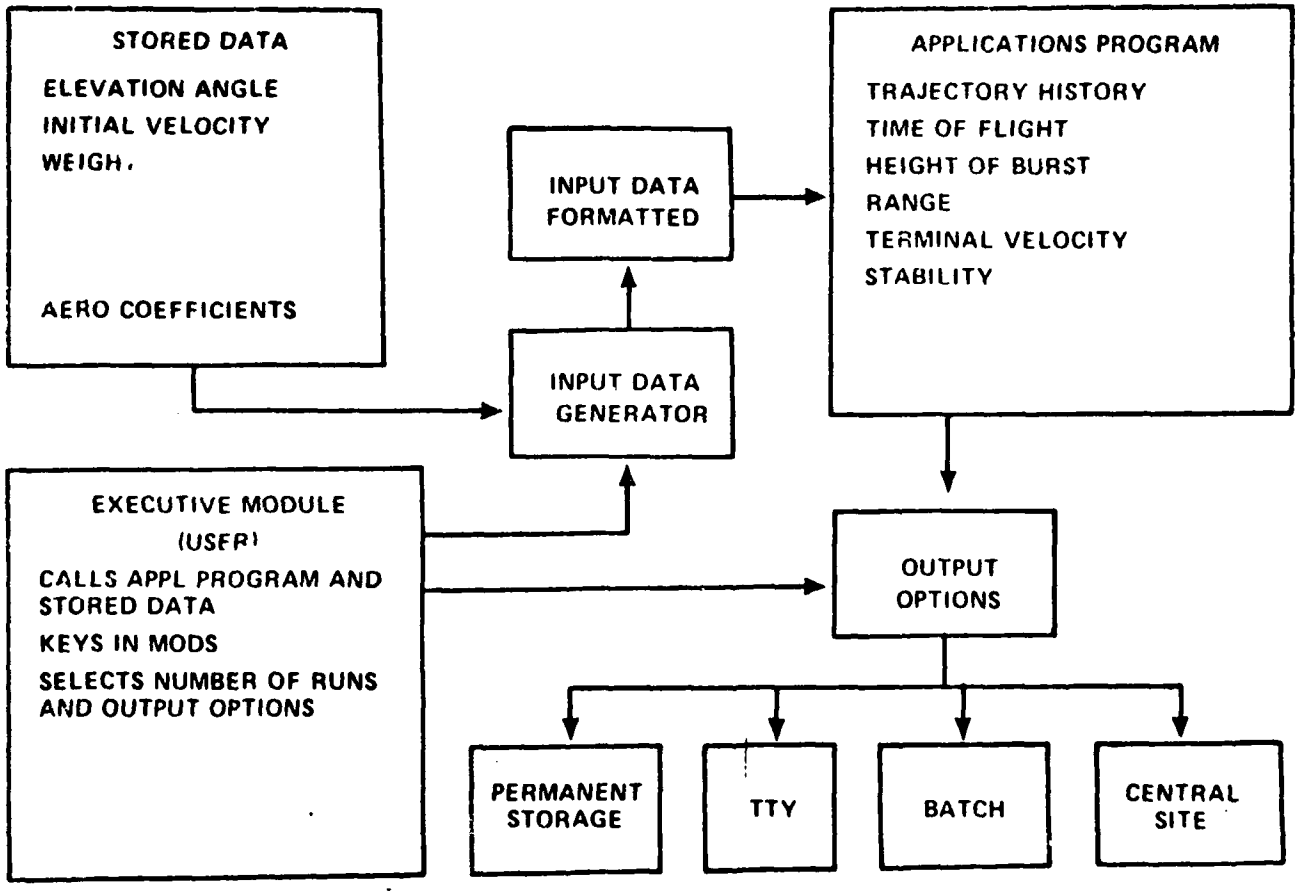


FIGURE 1

INPUT - OUTPUT INTERFACE

(EXTERIOR BALLISTICS)



IPSSM FLOW DIAGRAM
(HE VERSION)

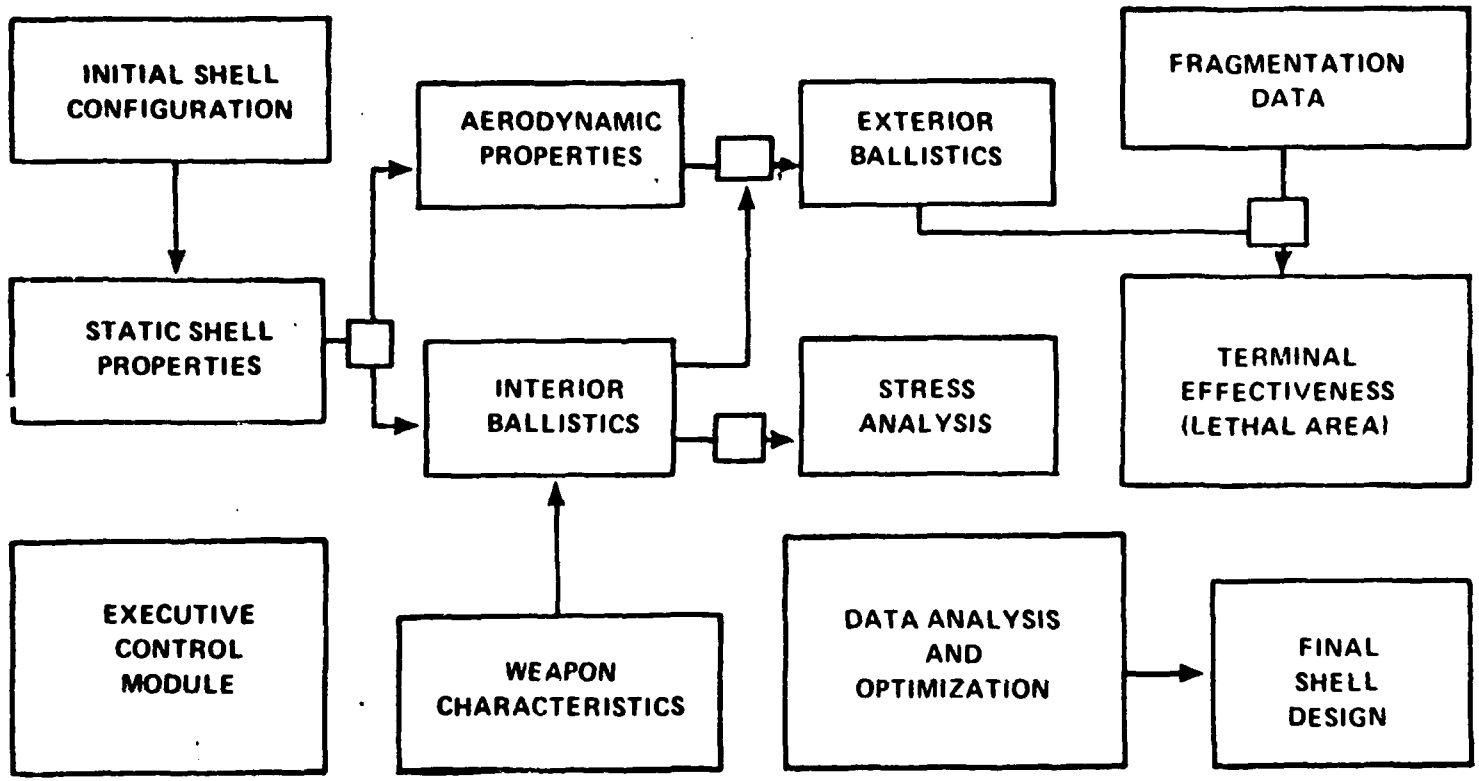


FIGURE 3

USER INSTRUCTIONS

A. Data Preparation

1. General

In order to execute the IPSSM Program, a data base containing the generic characteristics of the projectile to be analyzed must be available. This is established initially through the use of a program called IPSDATA (Cycle 5). Subsequent to this, data may be added, deleted, or changed either by rerunning IPSDATA with the modified data base cards or by using IPSSM's executive program, which is called IPSM (Cycle 5). The latter option may be accomplished through either the batch or the teletype (TTY) mode.

2. Data Base Generation Using IPSDATA

The program called IPSDATA was written for easy cataloging and checking of an entire data base. Use of the following deck of cards will result in your data base being entered on whichever permanent file you specify:

```
(JOBCARD),CM75000.

(COMMENT CARD)

ATTACH,IPSM,IPSD,CY=5,ID=NICHOLS,MR=1

IPSM.

(7/8/9 CARD)

(DATA BASE CARDS)

(6/7/8/9 CARD)
```

The first data base card contains the title to be associated with your data base. The second card contains the cycle number followed by a comma and the permanent file name (up to 10 alpha-numerics) in which you wish your data base to be stored. These two cards are followed by the key variable data cards. Each such card is identified by its three-letter symbol in the first three columns. The fourth column is blank. The value of the variable is then entered in free floating point format (cannot be integer) on the card anywhere in the next ten columns. Following the last key variable data card is a

card with the word "END" punched in the first three columns (see Sample Input for Initial Data Base Generation).

The key variable data are followed by the table entries required to execute the AERO 1 (AR), WEIGHT (WT), and LETHAL AREA (LA) Programs. Format for entering these tables is described in the discussions of programs in " Application Programs and Descriptions".

"Sample Input for Initial Data Base Generation" contains an example of a set of data base cards for the M106 8-inch Projectile which permits execution of the first five programs listed on page 3. Other data sets were generated in a similar manner to execute the remaining programs currently in operation within IPSSM. These sample data can be used to test the operation of each application program within IPSSM. (See "Sample Test Cases and Setup" for typical batch and TTY runs). These files will remain in the system as a permanent file for users to become familiar with the IPSSM System.

When establishing an initial data base, it should be noted that IPSDATA will store the data base in the requested cycle under a permanent file name of the form PFNXX, where PFN is the particular permanent file name you have selected, and XX is the symbol for the particular application program being run (AR, WT, LA, etc.). IPSDATA attaches these last two letters automatically by determining what data are being catalogued in that particular run. For example, if for an initial run of IPSDATA, the user includes data for the AR and LA programs and specifies that he wishes the data base stored in JOHN, cy=5, IPSDATA will automatically create two data bases: JOHNAR, cy=5 will contain the data needed to run the AR program and JOHNLA, cy=5 will contain the data needed to run the LA program. NOTE: This automatic appending of the two-letter program symbol is only done when running through IPSDATA; any subsequent modification of data bases using the executive program IPSH will recatalog the modified data base exactly as specified at the time of modification.

3. Multiple Value Option for Running Parametric Studies

As part of the general data base setup within IPSSM, a provision exists for entering up to six values for each key variable. Such an option can be useful in preparing combinations of runs where key variables take on different values and, in addition, may require the simultaneous change of other key variables. The technique for entering such data is described in subsequent paragraphs. The symbols, P, L, and N will aid in this description. These symbols can be associated with the words "permutation", "link", and "number", respectively.

This system is not unique to IPSSM. It has been used quite successfully in several other programs written at Picatinny Arsenal.

To begin with, each key variable has a P, L and N number (all integers) associated with it. N simply denotes the number of different values currently available for the given key variable. The P and L values are used to set up run combinations. The value of L determines whether or not the given key variable is "linked" with any other key variable. That is, in a combination of runs, if the L value for two or more key variables is the same, each of these variables will change their values simultaneously on each successive run. Finally, the P value determines the variable to be changed on each run and the number of runs to be made. For those variables which are linked through the L value, only one of these variables can have a nonzero P value. This is evident since when one linked variable changes its value, all other variables linked to it will also change. By assigning different L values, it is clear that sets of linked variables can be identified. Since L is currently restricted to the integers 1 through 9, nine sets of linked variables can be defined, if necessary. It should be stressed that only one variable within each set can have a nonzero P value.

As an example, suppose three key variables AXX, BXX, and CXX were to be varied in a combination of runs. Let AXX have two values and be independent of BXX and CXX. Let BXX and CXX have three values each and suppose they are linked. Then, to run all combinations under these assumptions AXX, BXX and CXX would have the following P, L and N numbers:

	P	L	N
AXX	2	0	2
BXX	3	1	3
CXX	0	1	3

NOTE: Variable BXX in this case is used as the "permuted" variable.

4. Format and Use of P, L and N Numbers

At this point the meaning of the P, L and N numbers (abbreviated PLN numbers) should be clear. This paragraph describes how data are entered and modified within the data base when PLN numbers are involved. In paragraph 2 preceding, the entering of only single values for each key variable was described. In this case, the IPSDATA

program automatically associates a PLN of 101 to each entry. If a PLN number other than 101 is used, then a comma is entered in column four (rather than a blank) and the PLN number is entered in columns 5, 6 and 7. The N values (up to 6) are then entered in the remaining columns of the card in free floating point format separated by commas. No blanks are permitted following the first data entry.

Modifications of an existing data base to include PLN values other than 101 are described in the instructions for running the executive program in Batch or TTY mode. (See parts B and C of this section.)

5. Data Base Modification Using the Executive Program

In order to modify an existing data base using the executive program (IPSH) (as opposed to creating an entirely new data base file using IPSDATA), the initial data base must first be available as a permanent file. The procedure using the teletype is explained in Part B of this Section titled "Instructions for Teletype Mode" under question 10. This question, namely, "MODIFY DATA BASE, YES OR NO =" is answered "YES". This invokes questions 11 and 12 which allow the user to enter data for key variables, even if no values currently exist for that variable. In this way data can be entered for a number of variables. Where limited data entries are required, for example, in executing the Interior Ballistics Program or the Aerodynamic Coefficient Program, this method would be preferable. For entering data via the Batch mode, the user should refer to part C of this section.

B. Instructions for TTY Mode

1. General

The following pages indicate the instructions used to execute the executive program (IPSH) in the TTY mode. This mode is conversational and requires limited response to perform many useful operations. It is required for users who do not have access to a Batch Terminal, and is particularly useful in conjunction with a portable teletype. The system allows the user to access any program within the IPSSM System. Where extensive production runs are required, it is recommended that the Batch Mode be used. However, certain options for some programs are currently available only in the TTY mode.

The first instruction required to enter the INTERCOM System (see Reference 7, page 3-2) from the teletype is "LOGIN". The system

responds with "ENTER USER NAME" to which you type XXXXYYYZZZ where XXXX is a four letter user code assigned by the MISD.

YYY = Cost Center Code (See Reference 8, page 4-8)

ZZZ = Charge Code (See Reference 8, page 4-5a)

The system responds with "ENTER PASSWORD" to which you respond with the Picatinny Arsenal Code (Consult MISD).

The system then types some accounting information followed by the word "COMMAND:. From this point on, see the following table for specific IPSSM TTY instructions.

2. Explanation of "INPUT/OUTPUT OPTION LIST" (see question 23, page 18).

a. Teletype Options

The first two digits control the teletype function.

Put a "1" in the second place if you wish to come back to the teletype for the results of your run when it has finished. You will be asked to supply a permanent file name on which the results will be stored for eventual teletype display. In most cases, the results stored for teletype retrieval will be an abbreviated version of the complete results.

If, in addition to these abbreviated results, you would like the values of specific variables to be printed out, include a "1" in the first place. You will then be asked to identify these variables (up to 6).

b. Data Base Transfer Option

The third and fourth digits are used to replace particular data base values with new values obtained during your current execution of an application program.

This option can currently be used in two modes: when running the SP program, part of the SP output contains variables that are required in the AR input. Likewise, portions of the WT output are variables that are used as SP input. Thus, either an AR or SP data base can be automatically updated with this option when running either the SP or WT programs, respectively.

Specific TTY Instructions

TABLE 1

QUESTION	EXPLANATION	RESPONSE EXAMPLE
a. Command	Attach the executive program (IPSM)	ATTACH,IPSM,IPSH,CY=5, ID=NICHOLS,MR=1
b. Command	Start Execution	IPSM.
1. THIS IS IPSSM MODE TTY OR BATCH =		TTY
2. WILL THIS BE A NEW RUN, YES OR NO =	YES indicates a new run, NO signals the program that you have previously entered a run and are now coming back for the results.	YES
3. PROGRAM =	Enter the two-letter symbol and one digit corresponding to one of the nine application program names in IPSSM's library and the current operational cycle number of that program. Current library symbols are:	AR5 or

QUESTION	EXPLANATION	RESPONSE EXAMPLE
	AR - aeroballistics program	IB5
	IB - interior ballistics	
	SP - spinner (aerodynamic coefficients)	etc.
	WT - weight (static properties)	
	LA - lethal area	
	TR - six-D trajectory program	
	RM - recoil mechanism design program	
	SD - sabot design program	
	IH - Heppner-interior ballistics	
4. DATA LOCATION: CY, PFNAME =	Enter the cycle number, a comma, and then the name of the permanent file where your data base is stored.	4,XM58
5. GRAPHICS YES OR NO =	This question will be asked only if you are running the WT program. If you answer YES, you will be asked to name a permanent file to store data to be used at the graphics terminal	YES

QUESTION	EXPLANATION	RESPONSE EXAMPLE
(The title of your data base will be written out)		(no response)
6. EXAMINE DATA BASE, YES OR NO =	NO - Program will skip to question 10 YES - If you wish to ask the value(s) of specific variables in your data base.	YES
7. SYM =	Type in one three-letter variable symbol from the application program, or type in the word ALL if you wish to examine all of the key variables for that program.	WGT
8. P = X, L = Y, N = Z VALUES = XX.X, YY.Y	See pages 8 - 10 for explanation of P,L and N	
9. SYM =	Type in the next three-letter variable symbol you wish to inspect. When you have finished examining data base values, type END.	END

QUESTION	EXPLANATION	RESPONSE EXAMPLE
10. MODIFY DATA BASE, YES OR NO =	No - if you wish to run the data as it is stored program will skip to next appropriate question. YES - if you wish to change one or more values.	YES
11. SYM, PLN =	See instructions for creating initial data base	WGT,202
12. VALUES =	The number of values entered must be the same as the last digit entered from previous question. Use a decimal point in each value. Separate the values with commas. (Leave no blanks)	200.,202.5
13. SYM, PLN =	When you have finished changing the data base for this run, type END.	END

QUESTION	EXPLANATION	RESPONSE EXAMPLE
14. DELETE TABLES, YES OR NO =	This question will be asked only if you previously indicated that you are running the AR program. For other programs, it will skip to question #18. The AR program will not run successfully if there are too many tables left in the data base for the number of flight phases that are being run in the present case. Accordingly, tables may have to be deleted.	YES
15. TABLE NO. =	Insert the number of the first table you wish deleted.	12
16. TABLE NO. =	Insert the number of the next table you wish deleted.	13
17. TABLE NO. =	When you have finished deleting tables, type END.	END

QUESTION	EXPLANATION	RESPONSE EXAMPLE
18. CHG ITEMS YES OR NO =	This question will be asked if you have indicated that you are running the WT program. A response of NO signals the system to ask question 19. If you type YES a series of additional questions are asked to change, add, or delete shell items. (See pages 26-27 for these procedures).	NO
19. STORE MOD DATA, YES OR NO =	This question will be asked if you answered yes to either of questions 10 or 14.	YES
20. NEW TITLE =	Enter a title for your new data base.	M106 TEST CASE
21. WHERE DO YOU WISH TO STORE MOD DATA: CY, PFNAME =	Specify cycle number and name of permanent file (10 or less alpha-numerics).	3,TEST
22. MOD DATA STORED: CY = 3, PF = TEST		(No Response)

QUESTION	EXPLANATION	RESPONSE EXAMPLE
23. INPUT/OUTPUT OPTION LIST (Y=1, N=0) TTY, DB, TERM, CS =	This question calls for a response of two digits (either 1 or 0 signifying yes or no, respectively) for each of the four input/output option categories: teletype, data base, terminal, central site. (See paragraph 2 for further details.)	11001100
24. CORE REQD: CM,T =	Note - CM values must be octal. T is in system seconds (decimal).	177000,180
25. COST CENTER - CHARGE CODE XXX-XXX =		123-123
26. STOP 00	First response example will place the run in the input queue of the central site. Second response example will place the run in the input queue of remote terminal XX.	BATCH(JOB,INPUT) OR BATCH(JOB,INPUT,XX)
27. IPSMXXX.$0000 etc.	Job is now in input queue under the name of IPSM.	(No Response)

QUESTION	EXPLANATION	RESPONSE EXAMPLE
28. COMMAND -	If you wish to enter another case, the second response example will recycle the IPSSM program.	LOGOUT OR IPSM.

A "0" in the third position together with a "1" in the fourth position indicates an automatic replacement of old values with current ones in the AR or SP data base specified. If a "1" is entered in both the third and fourth positions, the system will take the current output values and update the old data base specified into a new data base defined by the user, and, in addition, will allow the user to enter a title for his new data base. In this instance, the old AR or SP data base will remain intact with its original values.

A "0" in both the third and fourth positions indicates that no data transfers will be made.

c. Batch Terminal Option

The fifth and sixth digits control printing on remote terminals.

A "1" in the sixth position will provide a complete set of results at the remote terminal.

A "1" in the fifth position will cause the input data sets (as modified for the present run) to be printed out at the remote terminal site also. This will facilitate future identification of the computer run with the input data base that generated it.

d. Central Site Option

The seventh and eighth digits control the disposition of output to the central site.

A "1" in the eighth position disposes the results at the central site.

A "1" in the seventh position also copies the input data sets to the central site.

3. IPSSM Short TTY Inputs

For users who have become familiar with the TTY mode, input can be entered more quickly as shown below:

a. If the run is going to be a new one, questions 1, 2, 3, 4 of paragraph 2 may be answered at once in the following manner:

Question 1. THIS IS IPSSM

MODE: TTY OR BATCH =

TTY,AR5,5,XM58

If one of the answers is not accepted by the program, an error message will be printed and the program will ask you to correct the information.

b. Questions 22 and 23 may always be answered together in the following manner:

Question 22. TTY, DB, TERM, CS =

11001100,177000,180

C. Instructions for Batch Mode Operation

1. General

If the user has access to a card reader at the central site or at a batch terminal, he will probably find it more useful to run IPSSM via card input. Four options are currently available:

a. Modify and store new data base file.

b. Delete tables used in the exterior ballistics (AR) program.

c. Prepare data for the graphics (PROM) program.

d. Perform and store error computations for the exterior ballistics (AR) program.

2. Control Cards

In this mode, the executive program generates input data on a local file named TAPE9. The executable (LGØ) file of the program selected is copied to a local file named TAPE8. The control cards listed on the following page provide the necessary cards to attach and run the executive program, which, in turn, executes the selected application program. Cards enclosed in brackets are included only if you are making use of the error analysis option. The cycle number

which you specify here when cataloging the permanent file ERRØR must agree with the number you specify on the ERRØR card (paragraph 3).

```
(JØBNAME),CM145000,T210.
(CØMMENTCARD)
ATTACH(IPSM,IPSH,CY=5,ID=NICHØLS,MR=1)
IPSM.
REQUEST,TEMP3,*PF.
REWIND,TAPE9.
CØPYSBF,TAPE9.
REWIND,TAPE9,TAPE6,TAPE10.
RFL,145000.
MAP(ØFF)
REWIND,TAPE12.
CØPYBF(TAPE12,TEMP1)
REWIND,TEMP1.
RETURN,TAPE12.
TAPE8(TAPE9).
REWIND,TAPE6.
CØPYBF(TAPE6,ØUTPUT)
REWIND,TAPE12.
CØPYBF(TAPE12,TEMP2)
REWIND,TEMP2.
REWIND,TAPE12.
```

```
CØPYBF(TEMP1,TAPE12)

BKSP(TAPE12,1)

CØPYBF(TEMP2,TAPE12)

REWIND,TAPE12.

CØPYBF(TAPE12,TEMP3)

RETURN,TAPE12.

REWIND,TEMP3.

CATALØG(TEMP3,ERRØR,CY=N,ID=NICHOLS)

(7/8/9CARD)

(BATCHINSTRUCTIONCARDS)

(6/7/8/9CARD)
```

NOTE: The CM and T values specified on the job card must both agree with the values specified on card (b) of the batch instruction cards (see next paragraph).

3. Batch Instruction Cards

In order to explain the use of batch instruction cards, the following example illustrates all available options:

```
a.  BATCH,AR5,5,M106AR

b.  00011100,145000,210

c.  DATA

    VMX,202

    2500.,2700.

    THD

    30.

    END
```

d. TABLE,2,NEWM106 NEW PROJECTILE RUN

11

12

END

e. GRAPHICS,4,PFNAME1 GRAPHIC DISPLAY TITLE

f. ERRØR,1,NICHØLS

The explanation is given in terms of the card numbers designated on the left.

CARD a:

The word "BATCH " is entered in the first five columns followed by a comma in column 6. Columns 7 and 8 will have the two-letter symbol corresponding to the program in IPSSM's library that is being run. Column 9 is the number specifying the current operational cycle number of that program (usually 5). Column 10 contains a comma, followed by the cycle number, a comma, and the name of the permanent file where data base is located.

CARD b:

In columns 1-8 are entered the input/output option list values (for explanation-see question 23 and paragraph 3 of Part B), followed by a comma in column 9. The computer core and time required to execute the applications program are entered next, separated by a comma. The core requirement is designated in octal. See note on page 23.

CARD c:

If changes in the data base are to be made, then a card with the word "DATA" entered in columns 1-4 is inserted next. The next card follows with the symbol of the key variable to be changed entered in columns 1-3. The PLN value of 101 will be assumed for that variable unless it is followed by a comma in column 4, in which case the different PLN number is entered in columns 5-7. The next card provides the value(s) for that variable in free floating point format (No blanks; start in column 1.) After all the data changes have been entered, a card with the word "END" punched in columns 1-3 is inserted to terminate this option.

CARD d:

If the AR program is being run and table deletion is desired, then a card with the word "TABLE" entered in columns 1-5 is inserted next. One of the table numbers to be deleted is entered in the first two columns of the next card. Each table number is indicated on a separate card. A card with the word "END" punched in columns 1-3 is inserted last to terminate this option. NOTE: A table card is permissible only if you are running the AR program. Otherwise an error message will be printed and your job will resume execution.

4. Storage Options

If it is desired to store the new data as modified by any run, additional entries can be made on either the DATA or TABLE cards as follows:

A comma is placed after the word "DATA" or "TABLE", followed by the cycle number and the name of the permanent file where the modified data base is to be stored. These entries must also be separated by a comma. A new title card for the new data base is also entered on the card in columns 25-80.

CARD e:

If the WT program is being run and it is desired to have the output made available for later display on the graphics projectile measurement program (PROMS), then a graphics card is included. The word "GRAPHICS" is entered in columns 1-8, followed by a comma. The cycle number in column 10, a comma, and the permanent file name (starting in column 12) where you wish to store the graphics input follow. The title for the graphics display is also entered on the same card in columns 25-80. NOTE: A graphics card is permissible only when running the WT program. Otherwise an error message will be printed and your job will resume execution.

CARD f:

If the AR program is being run and it is desired that an error analysis be performed on the data for future teletype retrieval, then an ERROR card is included. The word "ERROR" is punched in columns 1-5, followed by a comma. Then the cycle number (corresponding to the one specified in the control cards) is punched in column 7, followed by a comma and the ID name, NICHOLS (starting in column 9). Example 11 on page 56 illustrates the method of retrieving on the

teletype the error analysis stored in this way. NOTE: An ERRØR card is permissible only when running the AR program. Otherwise an error message will be printed and your job will resume execution. NOTE: Only the first two cards and the ERRØR card are order-dependent. The DATA, TABLE, and GRAPHICS cards can be inserted in any order or any one or all of them can be left out. If the ERRØR card is included, it must directly precede the 6/7/8/9 card.

APPLICATION PROGRAMS AND DESCRIPTIONS

In order to have this manual somewhat self-contained without making it too cumbersome, a brief description of each application program is provided in this section. References to more complete documentation are given, together with options available through the use of the executive program (IPSH). References are also made to specific appendices which describe key variable input and tables required to each program.

A. Static Properties and Stability Calculations (WT)

The program used in IPSSM for performing static property calculations is a program currently known as WEIGHT. An earlier version of this program was called DAGMAR. Reference 1 contains the latest complete instructions and use of the weight program. The key variables associated with this program through IPSSM are given in Appendix A1. In addition to the key variable input, the description of each shell item, i.e. body, fin, known and ogival is entered following a card with the name WGTTAB punched on it, starting in Column 1. The format for entering this information is identical to that used in the WEIGHT program. For completeness, this format is given in Appendix A2; however, for a complete explanation of reference points, associated diagrams and the equations used, see Reference 1. The variables named NBI, NOF, NFP, NKI and NOI provide the number of body, fin, fin pieces, known and ogival items, respectively. The number of cards following WGTTAB must agree and correspond with the values given for the key variables. Following the shell description cards is the card with ENDWGT punched in columns 1 to 6.

The executive program (IPSH) is capable of changing the shell items in a similar way to that done at the graphics terminal. The procedure is written in conversational mode that starts with the question: "CHG ITEMS, YES OR NO = ". (See question 18 -- TTY Instructions). If the answer is NO, the executive routine continues by asking the question; "STORE MOD DATA YES OR NO = " (question 19).

However, if you answer YES, the program asks the following: "ITEM TYPE - BDY, FIN, KNO, OGV OR END -". You may then select the appropriate type or end the process with END. Having selected an item type, the next question is; "DEL, ADD, OR CHG -". Typing DEL means you wish to delete one entire item (line) of the type you selected. The program will then ask for the item number: "ITEM NO. =". The item number corresponds to the particular location of the item, i.e., line number within its group (body, fin, or ogive). This can most easily be determined by looking at a previous WT run on which the items are numbered within their group.

WARNING: DEL should be the last operation specified, after all ADDs and CHGs are performed, as the lines will be automatically re-numbered after each deletion and any subsequent attempts to add or change item numbers will most likely be inaccurate.

For the same reason all deletions should be specified in the order of the highest item number first to the lowest item number last. ADD requires that you specify additional data for the item type selected. The data are then typed in free floating point format as it is asked for and the new item is automatically entered into the data base for the run being made. These changes are not permanent unless you store the modified data base. The CHG option requires that you specify the item you wish to change and then the field within that item that you wish to modify. Field one represents the first formatted entry on that particular body, fin, or ogive card; field two the second, and so on.

These options allow for limited modifications of the shell configuration via the teletype. Obviously, the graphics system called PROMS (Reference 2) with a visual display is much easier to work with, particularly if you are working with new shell designs. However, for a limited number of straightforward design changes the user may find it more convenient to use the teletype located in his immediate area. The TTY procedure is not recommended for any extensive changes.

In addition to this option, the executive program can also prepare data for use with the PROMS system. After selecting the weight program (WT), the question "GRAPHICS YES OR NO=" will be asked. If your answer is YES, you are then required to specify a cycle number and permanent file name to store the data for a subsequent graphics run.

The graphics output (currently in the form of cards) can then be re-entered into the data base for additional IPSSM runs.

B. Generation of Aerodynamic Coefficients (SP)

The program used in IPSSM for calculating aerodynamic coefficients is a program known as SPINNER. The documentation for this program is given in Reference 3. The program was originally written in Fortran IV for use of the IBM 360/65. Later it was converted to run on the CDC 6500. Computational techniques used to estimate the aerodynamic coefficients of spin-stabilized projectiles are based upon the use of empirical equations and apply for Mach numbers from 0.01 to 3.0. The key variable data required to execute the program are given in Appendix B. The following aerodynamic coefficients are predicted by SPINNER for projectiles of 3.6 to 9.0 calibers in length, with ogival nose lengths of 1.8 to 4.0 calibers and boattail lengths between 0.0 (square base) and 1.0 calibers:

Zero Yaw Drag Coefficient

Normal Force Coefficient Derivative

Pitching Moment Coefficient

Magnus Force Coefficient Derivative

Magnus Moment Coefficient Derivative

Damping in Pitch Coefficient Derivative

Spin Deceleration Coefficient

The formulas are based upon the use of "standard" projectile length, and center of gravity from the standard.

The SPINNER Program does provide the engineer with a rapid, accurate technique for estimating the aerodynamic coefficients for use in preliminary design studies. However, SPINNER results should be checked against reliable aerodynamic data when available. (The above remarks are excerpts from Reference 3.)

C. Interior Ballistics Calculations (IB)

The program used in IPSSM for interior ballistic calculations is a short FORTRAN program called INTERIOR BALLISTICS, and is described in Reference 4. The program uses a series of simple equations to compute muzzle velocity given charge weight,chamber volume,maximum pressure,and other variables shown in Appendix C. The program can also be used to calculate charge weight if the muzzle velocity is known. However, the process used in this case is an iterative scheme which usually converges. Maximum pressure can also be estimated by another iterative process. The codes required for the key variable PKI are 1.0, 2.0, 5.0, 6.0, 8.0, 9.0, 10.0, 15.0, 17.0, 26.0, 30.0, 31.0 which represent the propellants M1, M2, M5, M6, M8, M9, M10, M15, M17, M26, M30, and M31, respectively.

D. Exterior Ballistics Calculations (AR)

The program used in IPSSM for exterior ballistic calculations is a two-stage, point-mass trajectory program called AEROI with drag cancelling and stability calculation options. One of the original versions of the program was known as RKTCAN, which was written in 1962. The most recent documentation for this program can be found in Reference 5. It was written for the IBM 360/65 and did not contain the stability calculations. In 1966 a new version of RKTCAN was written to include stability, and is currently known as AEROI. Documentation for this program is contained in Reference 6. Basically, the program can be used for both one and two-stage missiles or Rocket-Assisted Projectiles (RAP). The trajectory calculations are divided into the following four phases:

Phase I	Acceleration of Booster and Main Stage
	a. Start from Launcher (VMX=0.)
	b. Start without Launcher (VMX greater than zero)
Phase II	Coasting of Main Stage
Phase III	Acceleration of Main Stage
Phase IV	Free Flight of Main Stage

For calculations involving Rocket-Assisted Projectiles, only Phases III and IV are required. Other combinations can be used, depending on the functions of the missile or projectile. A purely ballistic trajectory may be simulated by either Phase II or Phase IV. A listing of the key variables used in this program is given in Appendix D1, together with an explanation of their meaning, values, and format. The program tables required for the program are given in Appendix D2. For consistency, all tables are described by the same format, which requires six cards. The first three denote values of the independent variable (mach number, altitude, or time); the last three give the values of the dependent variable (drag coefficient, thrust, weight, density, temperature, etc.). Each card is in 10F7.0 format.

All table cards are inserted in the initial IPSDATA data deck behind two table control cards. The first card has the name EXTTAB punched on it starting in column 1. The second card denotes the tables to follow. Each column of the card corresponds to the number of the table to be inserted. A 1 in any given column indicates that the correspondingly numbered table will be included. For example, a 1 punched in column 1 of the card would indicate that six cards for Table 1 would appear next. A blank in any column indicates no corresponding table will be inserted. Thus, the second card indicates the tables that follow (in order) corresponding to the column number containing a 1. Depending on the value of certain key variables listed in Appendix D1, certain tables must be inserted for proper execution of the AEROI Program. However, any table can be stored initially in the data base as long as the appropriate ones are deleted when setting up a run through the executive program (IPSH). The AERO I table cards must be followed by a card with ENDEXT punched in columns 1 to 6. For the TTY mode, tables, by number, can be deleted one at a time (see Instruction for TTY mode, page 10). For the batch mode, tables are deleted by a number following the card labelled "TABLE" (see Instruction for Batch Mode, page 21). All aerodynamic coefficients are "C" coefficients. The conversion of "k" coefficients to "C" coefficients is given in Reference 6.

A fixed flat earth and the 1959 ARDC standard atmosphere are used when no other option is identified. Provision for inserting nonstandard atmospheres is provided by the use of the key variable NAT and Tables 19 and 20.

E. Terminal Effectiveness Calculations (LA)

The effectiveness program used in IPSSM computes the lethal area of fragmentation ammunition. It has many options and computational features that are described in references. The essential input to the program is the fragmentation data as a function of "zones" described with respect to the axis of symmetry of the shell. A zone is the region between two conical surfaces whose axes are at the center of gravity of the round and whose half-angle is measured from the nose end of the round. Fragmentation data within each zone consist of the number of fragments within given weight groups and the initial velocity of the fragments. Each fragment in a weight group has a weight equal to the average fragment weight. All fragments within a given zone are assumed to have the same initial velocity. However, their drag is dependent upon a shape factor, the size and weight of the fragments themselves, and the type of media (air, grass, leaves, etc.) through which the fragment will travel.

The shell is assumed to detonate at some point in space above the target area or at impact with the ground plane. The shell may have a terminal velocity at detonation. Its angle of fall with respect to the ground plane is also required input. The targets for this program are personnel in various postures such as prone, standing, or in foxholes and are also assumed to be in some stage of military readiness. These military situations are described further in the references. Those who use the program will recognize the required key variables given in Appendix E.

The program is also capable of generating probability of kill (PK) matrices in the ground plane. In this case, the target area is divided into rectangular cells that can be specified by the user or generated internally, depending upon the option called for by the input data. The PK is then calculated for each cell. The PK matrices can then be used in other lethality programs to determine the effectiveness of volley fire and multiple round firings. Programs which evaluate multiple round effectiveness could be incorporated into IPSSM at some future date, if desired.

Another significant feature of the program is its ability to account for velocity decay of the fragments as they pass through different layers between planes parallel to the ground plane. The regions between layers can represent various types of media representative of environments such as grass, jungle tangle, or high canopy forests.

It should be emphasized that for purposes of the IPSSM system some of these sophistications need not be used to obtain a preliminary estimate of the shell's lethal potential. However, having this program available does allow for parametric studies to be made in an easy manner by varying the key variable data.

The format of the fragmentation data is identical to that used when running the lethal area program independent of IPSSM. Preceeding the fragmentation data is a card labelled FVMTAB in columns 1 to 6, and following the last fragmentation data card is a card labelled ENDFVM. Data describing the fragment drag tables are separated in a similar manner by cards labelled FDXTAB and ENDFDX in columns 1 to 6. This table is required and must contain at least two values for both the dependent and independent variables.

F. 6-D Trajectory Program (TR) (references 9, 13)

The six degree-of-freedom missile trajectory program may be utilized to compute trajectories for one and two-stage rockets and/or ballistic projectiles (fin and spin-stabilized) and consists of the following phases:

Phase I	Acceleration of Booster and Main Stage
Phase II	Coasting of Booster and Main Stage
Phase III	Separation of Booster from Main Stage
Phase IV	Coasting of Main Stage
Phase V	Acceleration of Main Stage
Phase VI	Free-flight of Main Stage

Any of these phases may be excluded in the computation. For ballistic trajectory computations, only Phase VI is required.

Thrust values for the acceleration phases (I and V) are obtained in the computation by linear interpolation of a thrust versus time table. Provisions in the program permit altering the table thrust values by using a constant thrust modifier term. Also, the correction of presented thrust data for changes of atmospheric pressure with altitude may be performed, if desired, by the user.

Thrust misalignments may be introduced by establishing the thrust misalignment distances and angles as input data. Also, a constant jet torque may be introduced.

A linear change in mass during acceleration or a change in mass as a function of the thrust and specific impulse of the rocket propellant is another option for phases one and five. If a separation thrust is required in phase three, only a linear mass change is computed.

During all acceleration phases, center of gravity and moments of inertia are varied linearly with time.

Range, cross-range, and vertical winds may be introduced in the program in tables as functions of range and altitude for flat earth profiles. At present, wind equations for a spherical earth have not been included in the computer program because data formats for these wind profiles have not been made available. Constant flat earth winds may also be introduced for the entire trajectory. Inclusion of winds in the computation is an option and not required for all trajectories.

Normal force, yaw damping, drag ballistic coefficients, and normal force center of pressure axial positions are introduced in the program as table functions of mach number and angle of attack. When they are available, magnus, roll moment, and roll damping (or spin deceleration) ballistic coefficients and the magnus force center of pressure positions may also be included as table functions of mach numbers and angle of attack. For entry of tabular data, consult Aeroballistics Branch, FRL, Picatinny Arsenal.

G. Recoil Mechanism Design (RM)

This program was written at Rodman Laboratories, Rock Island. Documentation is not available at this time. It is suggested that Mr. B. Moody at Rodman be contacted for further information.

H. Sabot Design Program (SD)

The program SABOT DESIGN is currently used in IPSSM for the determination of sabot design parameters. Before a weapon system can be designed and tailored to achieve stated objectives, adequate design criteria must be established. In the case of weapon systems employing saboted flechettes, many interdependent variables are present that serve to confound the design process. Reference 10 contains the latest complete instructions for the use of the SABOT DESIGN Program, which can accomplish the coordination of such

variables as sabot geometry, inbore pressure, intersegment spacing, bore friction, sabot density, and flechette weight. These and other key variables associated with this program through IPSSM are listed in Appendix H.

In addition to various numerical analyses, SABOT DESIGN is capable of producing Calcomp and printer plots of inbore loading through the use of the NANCY plotting routine. Examples can be found in Reference 9.

The SABOT DESIGN Program enables a sound engineering approach to sabot design that, in the past, largely relied upon numerous cut and try methods. At Frankford Arsenal, where the program was written, it has already been used to design two functional flechette/sabot assemblies.

I. Heppner Interior Ballistics (IH) (reference 11)

The use of multigranulation propellant charges requires improved ballistic theory for the prediction of interior ballistic phenomena. Accordingly, the Hitchock equations of interior ballistics were modified and new procedures developed that are more applicable to the high charge-to-projectile weight systems. These modifications, incorporated into the Heppner Interior Ballistics Program, give more reliable predictions of the effects of changes in the weight of the charge, the weight of the projectile, web size, and type of propellant and granulation of ammunition. The program performs all necessary computations for the high-velocity guns for any shape of propellant grain and multigrain charges.

Principal output is proportion of propellant burned, projectile travel and velocity, chamber pressure, pressure on the base of the projectile (all as a function of time), and "variable quickness" (as a function of projectile travel in the tube of the gun). Another feature of the IH program is that if experimental data (velocity and maximum pressure) are available for a particular system (gun, projectile, or propellant), the data can be used as a "basis" for calculations of additional pressure and velocity charge relationships for new systems to be studied. The closer the new system is to the basis system, the more accurate the calculations will be.

SAMPLE INPUT FOR INITIAL DATA BASE GENERATION

Following is a list of the data base cards used to generate the data base titled "PROJECTILE 8-INCH M106", using the IPSDATA program. These cards would be inserted into the deck format shown on page 7, and as a result of this run, five different permanent files (M106AR, M106TR, M106SP, M106WT, and M106LA) are created and catalogued (cy=5), as discussed on page 8 . Note that these five different files are created as a result of both 5, M106 being specified on the second data base card and the inclusion of data used by each of the five application programs. Appendix J shows the output of this run.

```
PROJECTILE 8 INCH M106
5,M106
DCS 1.0
AX4 1.
WCT 1.
ATH 2.0
XTH 1.0
WXX 2.
NLT 2.
AJD 1.
TSD 5.
THD 20.
WXX 3300.
WCT 200.
DIA 7.99
TH2 786.5
DT2 4.13
CAN 2.0
TW2 7.0
TW3 10.
TW4 6000.
ECT 1.2
EFA 1.0
DI2 .005
DI3 .005
DI4 .005
DW2 1.0
DW3 1.0
DW4 40.
TW5 20.
```

```
    TSP 1.05
    THP 2.0
    VMP 50.
    TSD 1.01
    TSD .6
    VSD 2.0
    PIT 2.5433
    XLT 155.
    VCT 200.
    MBT 50560.
    DMT 12.65
    PCT 8.58
    PKT 17.
    NVT 6.
    PLS 4.215
    NLS 2.273
    PLS .503
    PCS 2.215
    PTS 2.99
    AMS 1828.
    TMS 15510.
    WTS,202,200,,185.
    TST 22.
    PCS 0.
    STS 1.0
    NBT 25.
    NCT 4.
    NDA 2.
    SKD 1.
    NDI 2.
    NTT 2.
    PHB 20.
    ACF 47.
    TVM 1000.
```

```
NCZ 37.
CCK 1.0
CKO .5905
NCD 11.
CCB 2.
NCC 12.
FAD
FRRTAB
                    11
0.010  0.600  0.8     .9     .95   1.00   1.05   1.100  1.20   1.35
1.5    1.75   2.0    2.5    3.0

0.135  .135   .14    .177   .227  .295   .361   .368   .449   .428
.313   .298   .263   .229   .200

0.010  0.600  0.8     .9     .95   1.00   1.05   1.100  1.20   1.35
1.5    1.75   2.0    2.5    3.0

0.135  .135   .14    .177   .227  .295   .361   .368   .449   .428
.313   .298   .263   .229   .200

FRDFYB
WGTTAB
 7.95   7.95   7.83   .283   19.28                 QRODY1  1
 7.98   7.98   1.80   .283   29.32                 QRODY2  1
 7.98   6.75   4.00   .283   31.12                 QRODY3  1
 7.99   7.99   .78    .283   18.50                 QRODY4  1
 7.90   7.98   .40    .283   18.10                 QRODY5  1
 7.91   7.91   .12    .283   29.12                 QRODY6  1
 7.91   7.98   .10    .283   29.22                 QRODY7  1
 6.47   6.47   6.70   -.223  18.10                 TRODY1
 4.86   4.53   1.42   -.223  31.11                 TRODY2
 6.07   5.50   2.50   -.223  26.50                 TRODY3
 5.50   4.86   2.11   -.223  29.00                 TRODY7
 6.30   6.07   1.20   -.223  25.30                 TRODY4
 6.47   6.30   1.20   -.223  24.10                 TRODY5
 6.00   6.00   .12    0.0    35.00                 TRODY6
 1.6    1.6    .10    0.0    3.75                  FRODYB
 1.6    2.0    .10    0.0    3.85                  FRODYC
 2.0    1.6    .10    0.0    3.85                  FRODYD
 1.6    2.0    .1     0.0    4.05                  FRODYF

 1.6    2.0    .1     0.0    4.25                  FRODYG
 2.0    1.6    .1     0.0    4.25                  FRODYH
 1.6    2.0    .1     0.0    4.45                  FRODYI
 2.0    1.6    .1     0.0    4.55                  FRODYJ
 1.6    2.0    .1     0.0    4.65                  FRODYK
 2.0    1.6    .1     0000000.0          4.75      FRODY
 1.6    1.6    1.15   .44    4.85                  FRODYM
 8.05   8.14   1.0    .283   27.12                 QRROTA  1
 8.05   8.08   .20    .283   28.12                 QRROTB  1
 8.14   8.14   .15    .283   28.32                 QRROTC  1
 8.14   8.28   .20    .283   28.47                 QRROTD  1
 8.28   8.28   .10    .283   28.67                 QRROTE  1
 7.91   7.91   .15    .283   28.77                 QRROTF  1
 8.12   8.12   .08    .283   28.92                 QRROTG  1
 8.12   7.98   .12    .283   29.00                 QRROTH  1
 7.53   7.53   2.00           27.12                 TRROTA
-18.90  60.    14.35  .283   3.75    64.10         COGIVE  1
-17.90  60.    13.25  -.223  4.85    63.40         TOGIVE
-18.50  60.    3.75   .1     0.0     63.0          FOGIVE  1
        -1.25  1.0    -.223  32.52   1.0           TCURVE
FRDWGT
FVMTAB
      0.000      2.500      1.250   2150.000   2366.667   2150.000      1.000
      1.000
```

0.000						
2.500	7.500	5.000	2366.667	2575.000	2800.000	1.000
1.000						
0.000						
7.500	12.500	10.000	2575.000	2325.000	2350.000	1.000
1.000						
0.000						
12.500	17.500	15.000	2325.000	2850.000	2300.000	1.000
1.000						
0.000						
17.500	22.500	20.000	2850.000	3100.000	3400.000	1.000
1.000						
0.000						
22.500	27.500	25.000	3100.000	2900.000	2800.000	1.000
1.000						
0.000						
27.500	32.500	30.000	2900.000	3100.000	3000.000	1.000
1.000						
0.000						
32.500	37.500	35.000	3100.000	3275.000	3200.000	1.000
.176						
32.798						
37.500	42.500	40.000	3275.000	3450.000	3350.000	2.000
.098	1.662					
31.321	7.825					
42.500	47.500	45.000	3450.000	3550.000	3550.000	2.000
.160	5.965					
36.400	9.494					
47.500	52.500	50.000	3550.000	4200.000	3550.000	4.000
.225	1.361	3.724	39.240			
19.063	9.517	9.517	9.517			
52.500	57.500	55.000	4200.000	4200.000	4850.000	4.000
.312	1.441	2.853	50.601			
65.932	9.407	9.407	9.407			
57.500	62.500	60.000	4200.000	3375.000	3550.000	7.000
.139	1.360	2.394	7.456	9.070	43.778	973.973
161.195	9.466	18.982	9.466	18.982	18.982	9.466
62.500	67.500	65.000	3375.000	3350.000	3200.000	11.000
.217	1.432	3.384	7.297	10.961	16.163	26.568
45.897	92.441	100.099	210.210			
113.791	9.466	18.982	9.466	9.466	28.448	9.466
18.982	9.466	9.466	9.466			
67.500	72.500	70.000	3350.000	3625.000	3500.000	17.000
.127	1.694	2.051	13.823	19.480	29.009	40.267
82.934	92.772	108.445	141.429	171.171	236.882	259.258
390.390	487.486	539.541				
179.971	18.948	9.474	9.474	9.474	9.474	28.423
9.474	9.474	18.948	18.948	9.474	18.948	9.474
9.474	9.474	9.474				
72.500	77.500	75.000	3625.000	3825.000	3750.000	13.000
.097	1.510	2.858	5.505	9.841	12.012	30.713
42.763	103.102	172.171	232.000	438.438	571.000	
180.038	37.892	37.892	9.462	9.462	9.462	37.892
9.462	9.462	9.462	28.429	9.462	28.429	
77.500	82.500	80.000	3825.000	4200.000	3900.000	18.000
.224	1.540	3.154	7.799	8.771	11.900	16.225
23.342	30.795	43.042	57.778	78.261	113.667	179.000
435.282	820.000	1117.576	2426.426			
246.389	37.886	47.358	9.471	18.943	28.415	9.471
9.471	37.886	9.471	9.471	18.943	28.415	28.415
18.943	28.415	47.358	9.471			
82.500	87.500	85.000	4200.000	4500.000	4500.000	14.000
.192	1.463	3.991	6.160	12.778	31.225	61.462
108.108	175.174	286.285	317.318	447.447	618.166	1404.405
350.531	37.892	47.396	28.450	18.946	18.946	9.442
9.442	9.442	9.442	9.442	9.442	56.838	9.442

87.500	92.500	90.000	4500.000	4425.000	4500.000	15.000
.153	1.677	3.318	7.143	12.433	17.053	29.880
46.547	55.209	87.438	120.120	182.183	308.309	853.333
1213.213						
417.276	9.487	85.384	28.461	18.974	28.461	37.948
9.487	37.948	9.487	9.487	9.487	9.487	56.922
9.487						
92.500	97.500	95.000	4425.000	3850.000	4350.000	22.000
.163	1.542	3.426	6.607	13.143	18.036	20.982
30.656	41.812	51.372	65.072	77.679	84.363	91.330
108.667	125.139	170.333	243.378	420.289	618.000	1383.723
2386.667						
369.687	47.396	37.917	9.479	47.396	18.958	9.479
47.396	75.833	9.479	18.958	9.479	9.479	9.479
28.438	9.479	28.438	18.958	18.958	56.875	47.396
28.438						
97.500	102.500	100.000	3850.000	3425.000	3350.000	24.000
.182	1.539	3.511	6.738	8.709	11.890	17.320
32.817	38.377	43.615	66.097	74.423	87.336	95.984
104.276	128.436	178.111	225.056	267.146	350.778	446.277
758.833	1485.784	4115.734				
767.654	123.177	132.775	104.180	9.398	37.993	37.993
28.395	56.789	47.391	37.993	28.395	18.996	37.993
37.993	18.996	85.384	37.993	47.391	85.384	18.996
56.789	66.387	75.786				
102.500	107.500	105.000	3425.000	3200.000	3500.000	14.000
.222	1.552	2.649	7.126	9.811	11.733	15.706
28.447	39.640	54.255	77.559	102.192	471.471	509.511
265.294	9.450	9.450	9.450	9.450	28.432	9.450
9.450	9.450	9.450	9.450	9.450	9.450	9.450
107.500	112.500	110.000	3200.000	2725.000	2900.000	7.000
.098	1.162	4.802	33.354	37.438	54.856	200.201
123.117	9.469	18.957	9.469	9.469	9.469	9.469
112.500	117.500	115.000	2725.000	2550.000	2550.000	7.000
.131	1.342	11.279	20.580	78.880	241.240	711.144
85.152	9.456	18.928	9.456	9.456	9.456	18.928
117.500	122.500	120.000	2550.000	2650.000	2550.000	7.000
.236	2.042	5.877	9.610	11.201	25.607	327.327
56.637	9.430	9.430	9.430	9.430	9.430	9.430
122.500	127.500	125.000	2650.000	2750.000	2750.000	7.000
.187	1.604	4.574	5.724	8.069	92.694	210.210
151.648	18.962	9.459	9.459	9.459	9.459	9.459
127.500	132.500	130.000	2750.000	2825.000	2750.000	13.000
.212	1.439	2.303	5.667	10.800	10.240	31.432
35.276	97.619	133.132	158.159	298.297	426.426	
680.759	66.210	9.420	28.350	28.350	9.420	9.420
9.420	9.420	9.420	9.420	9.420	9.420	
132.500	137.500	135.000	2825.000	2825.000	2900.000	9.000
.217	1.341	10.480	16.616	20.321	25.916	175.412
296.297	509.511					
811.825	54.773	9.113	9.113	9.113	9.113	18.226
9.113	9.113					
137.500	142.500	140.000	2825.000	2625.000	2750.000	10.000
.277	1.438	2.743	7.637	10.240	22.954	34.574
89.841	99.360	102.102				
543.737	39.421	39.421	7.884	7.884	15.768	7.884
7.884	7.884	7.884				
142.500	147.500	145.000	2625.000	2525.000	2500.000	4.000
.208	1.600	2.547	40.019			
552.130	32.871	19.710	13.161			
147.500	152.500	150.000	2525.000	2550.000	2550.000	5.000
.133	1.356	2.573	7.679	19.288		
345.976	21.626	16.220	5.406	5.406		
152.500	157.500	155.000	2550.000	2600.000	2550.000	8.000
.243	1.425	3.193	6.706	12.238	32.853	136.135
491.480						

213.575	26.164	26.164	4.351	8.731	4.351	4.351
4.351						
157.500	162.500	160.000	2600.000	2675.000	2650.000	12.000
.243	1.392	3.643	6.836	8.921	12.853	17.217
41.799	92.312	121.120	253.252	345.345		
209.494	16.905	23.661	20.268	6.756	3.362	13.512
6.756	3.362	3.362	3.362	3.362		
162.500	167.500	165.000	2675.000	2600.000	2700.000	16.000
.244	1.322	2.862	6.522	9.396	12.048	17.958
23.414	31.649	42.399	56.676	65.167	74.138	80.532
116.942	149.150					
144.475	19.585	48.978	12.237	4.889	14.697	19.585
4.889	4.889	4.889	2.460	7.348	4.889	2.460
4.889	2.460					
167.500	172.500	170.000	2600.000	2575.000	2500.000	23.000
.295	1.585	3.476	6.447	9.207	12.373	16.867
23.468	31.110	47.927	50.111	64.817	77.171	85.798
97.919	107.667	175.912	235.382	380.381	492.492	529.529
1661.661	2124.123					
107.916	16.727	13.684	16.727	4.554	6.087	7.597
3.043	6.087	3.043	1.511	3.043	3.043	3.043
1.511	4.554	3.043	3.043	1.511	1.511	1.511
1.511	1.511					
172.500	177.500	175.000	2575.000	3116.667	2650.000	24.000
.310	1.607	3.428	6.187	9.107	12.230	17.642
21.680	29.433	39.826	54.297	63.013	73.357	88.006
92.989	112.588	138.714	174.333	230.354	278.361	330.334
403.798	619.166	1539.471				
111.672	23.792	29.611	17.484	6.798	9.707	8.266
5.819	10.197	6.798	2.420	2.909	1.468	.979
2.420	3.389	4.867	5.819	2.420	.979	2.420
.979	2.909	7.776				
177.500	180.000	178.750	3116.667	3350.000	3350.000	21.000
.238	1.424	3.313	6.757	8.267	11.980	17.923
20.934	29.912	43.573	59.961	61.969	72.733	110.445
128.436	175.174	231.231	414.414	890.223	1515.500	2669.167
17.400	1.672	3.347	1.002	.333	1.339	1.002
.669	1.339	2.008	.333	.669	1.002	.669
.669	.333	.333	.333	1.339	2.008	1.339

ENDFVM

FDXTAB

0.0	670.0	893.0	1116.0	1339.0	1562.0	1786.0
2232.0	3348.0	5580.0	10044.0			
0.53	0.54	0.56	0.62	0.68	0.70	0.70
0.68	0.64	0.60	0.56			

ENDFDX

SAMPLE TEST CASES AND SETUP

A. Introduction

This section provides sample cases of both TTY and Batch runs using IPSSM. They are given to illustrate the use of the system as well as to show specific techniques. It is recommended that some or all of these cases be run by new users. The permanent file named M106 (Cycle 5) is available for this use and is used by all the examples. However, other data base files may be generated by the use of IPSDATA (Cycle 5). Care should be taken to specify different permanent file names than those catalogued in these examples to avoid conflict and possible job abort.

B. TTY Examples

1. General Information

The following lines show the initial login and attach procedure that is common to all the teletype examples mentioned in this manual. All subsequent examples will begin with the first statement generated by IPSSM, namely, "THIS IS IPSSM,

```
CONTROL DATA INTERCOM 4.8
DATE  05/28/76
TIME  13.18.48.

PLEASE LOGIN
LOGIN

ENTER USER NAME- LLPM888700
       [redacted] ENTER PASSWORD-

 05/28/76   LOGGED IN AT  13.20.23.
            WITH USER-ID JB
            EQUIP/PORT 40/16
COMMAND- ATTACH,IPSM,IPSM,CY=6,ID=NICHOLS,MR=1.
COMMAND- IPSM

THIS IS IPSSM
MODE- TTY OR BATCH .
```

MODE: TTY or BATCH=". All information shown underlined is user-supplied. Continuous reference to Table 1 should be made while reviewing the following examples; the batch outputs generated by these runs are shown in Appendix K.

2. Representative TTY Examples

a. Example 1 illustrates the running of the Static Shell Properties Program (WT) using the M106 data without modification.

```
THIS IS IPSSM
MODE- TTY OR BATCH =        TTY,UTS,S,M106MT
TITLE=
  PROJECTILE  8 INCH  M106
 REQUEST(TAPE10,SPF)
 REQUEST(TAPE8,SPF)
 GRAPHICS, YES OR NO =                  NO

 EXAMINE DATA BASE, YES OR NO =         NO
MODIFY DATA, YES OR NO=     NO
CMB ITEMS YES OR NO =       NO

 INPUT/OUTPUT  OPTION  LIST
 (V=1 N=0) TTY,SD,TERM,CS =             11001100
CORE REQD- CM,T =120000,115
TTY INPUT LIST- SYMBOLS =  NO1
 SPECIFY PFNAME FOR TTY RESULTS-
                  PFNAME,CY,ID-         SAVENT,1,NICHOLS

CATALOG CYCLE WAS   1
 CT ID=  NICHOLS PFN=SAVENT
 CT CY= 001   08/09/18 WORDS.1

 COST CENTER-CHARGE CODE,
              XXX-XXX =                 000-700

     STOP  00
        .514 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,AB
```

Note that the short TTY input (page 21) is used to answer question 1. Also, TTY results (a summary) are asked for and will be saved on a permanent file called SAVEWT (cycle 1), in addition to the more complete batch results that will be sent to the remote terminal site (see Appendix K-1 for entire batch output). Also, the number of shell body items (NBI) has been selected to be included in the TTY results for the user's own reference.

The following TTY run was used to obtain the TTY results stored previously on the file SAVEWT (Cycle 1). Note that, for reference, the number of shell body items (NBI) is also provided.

```
THIS IS IPSSM
MODE- TTY OR BATCH •        TTY
WILL THIS BE A NEW RUN, YES OR NO •  NO
WHERE WERE RESULTS STORED,PFNAME,CY,ID•        SAVEWT,1,NICHO
LS
  NBI       36.000

 PROJECTILE  8 INCH  M106

 PROPERTIES OF ENTIRE SHELL

 WEIGHT•  200.8185 POUNDS

 CG TO REF•   22.7413 INCHES

 POLAR INERTIA• 1800.5168  POUND INCH SQUARE

 TRANSVERSE INERTIA•15082.7227  POUND INCH SQUARE

 OUTER VOLUME• 1230.1008  CUBIC INCHES

     END OF TTY RESULTS

     STOP  000
        .103 CP SECONDS EXECUTION TIME
COMMAND-
```

b. Example 2 below also illustrates the running of the Static Shell Properties Program (WT), but, in this case, the density of body item number 3 is changed to 0.300. Ogival item number 4 has also been deleted. The complete remote output is given in Appendix K-2.

```
THIS IS IPSSM
MODE- TTY OR BATCH =        TTY,UTS,S,M106UT
TITLE=
  PROJECTILE  8 INCH  M106
 REQUEST(TAPE12,IPF)
 REQUEST(TAPE9,IPF)
 GRAPHICS, YES OR NO =                  NO

 EXAMINE DATA BASE, YES OR NO =         NO
MODIFY DATA, YES OR NO=    NO
CHG ITEMS YES OR NO =      YES
ITEM TYPE- BDY,FIN,KNO,OGV OR END =  BDY
DEL, ADD OR CHG =CHG
ITEM NO. =       03
FIELD NO., VALUE =         4,0.3
ITEM TYPE- BDY,FIN,KNO,OGV OR END =  OGV
DEL, ADD OR CHG =DEL
ITEM NO. =       04
ITEM TYPE- BDY,FIN,KNO,OGV OR END =  END
STORE MOD DATA, YES OR NO =NO

 INPUT/OUTPUT  OPTION  LIST
 (Y=1 N=0) TTY,DD,TERM,CS =             00001100
CORE REQD- CM,T =120000,115

 COST CENTER-CHARGE CODE,
              XXX-XXX =                 999-700

     STOP  00
        .517 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,A0
```

c. Example 3 illustrates the running of the Aeroballistics Coefficients Program (SP). TTY input is shown below. Batch output for this run is given in Appendix K-3. In this case, the key variable CGS (distance in calibers of the center of gravity from the nose of the projectile) is changed from 3.315 to 3.50. Note also that the two values of WTS (shell weight in pounds) are changed by re-entering only one value. The option to automatically generate a new data base with the permanent file name MOD (Cycle 1) and the title "MOD 8 IN PROJECTILE" is also accomplished. This data base can then be used by the Exterior Ballistics Program (AR) with the drag tables generated and stored by the SP program in the MOD file (Example 4).

```
THIS IS IPSSM
MODE- TTY OR BATCH =        TTY,SPS,S,M168SP
TITLE=
  PROJECTILE  8 INCH  M168
 REQUEST(TAPE12,SPF)
 REQUEST(TAPE8,SPF)
 EXAMINE DATA BASE, YES OR NO =        YES
     SVN =       WTS
         P = 2    L= 0    N = 2
         VALUES =    200.000   180.000
     SVN =       CGS
         P = 1    L= 0    N = 1
         VALUES =    3.315
     SVN =       END
MODIFY DATA, YES OR NO=    YES
    SVN,PLN=     WTS,101
     VALUES =    200.0
    SVN,PLN=     CGS,101
     VALUES =    3.5
    SVN,PLN=     END
STORE MOD DATA, YES OR NO =NO

 INPUT/OUTPUT  OPTION  LIST
 (Y=1 N=0) TTY,SO,TERM,CS =          00111100
AR DATA BASE TO BE UPDATED-CY,PFN=   S,M168AR
NEW DATA BASE FILE-CY,PFNAME =       1,MOD
NEW TITLE =      MOD 8 IN PROJECTILE
CORE NEED= CR,T =100000,100

 COST CENTER-CHARGE CODE,
              XXX-XXX =              000-700

    STOP  CP
      .SEC OF CHARGE EXECUTION TIME
CONTINUE= BATCH,JOB,INPUT,AS
```

d. Example 4 shows the running of the Exterior Ballistics Program (AR) using the MOD drag data generated by the SP program in Example 3. A recently added provision for conducting a partial error analysis in the AR program is utilized here. The data produced by the AR program are analyzed and stored in the permanent file ERRAN (Cycle 1). A second run is necessary to produce the analyzed results after the initial execution is completed. Below is the TTY input yielding the first set of results shown in Appendix K-4.

```
THIS IS XPROGM
MODE- TTY OR BATCH =        TTY,ABS,1,MOD
TITLE=
  MOD 8 IN PROJECTILE
 REQUEST(TAPE10,XPF)
 REQUEST(TAPE9,XPF)
 EXAMINE DATA BASE, YES OR NO =        NO
MODIFY DATA, YES OR NO=    NO
ERROR ANALYSIS  YES OR NO =YES
DELETE TABLES, YES OR NO = NO

 INPUT/OUTPUT  OPTION  LIST
 (Y=1 N=0) TTY,SD,TERM,CR =            01001100
CORE READ- CM,T =100000,300
 SPECIFY PFNAME FOR TTY RESULTS-
                PFNAME,CY,ID=          ERRAN,1,NICHOLS

CATALOG CYCLE WAS   1
 CT ID=  NICHOLS PFN=ERRAN
 CT CY= 001   00000128 WORDS.!

 COST CENTER-CHARGE CODE,
              XXX-XXX =                999-700

    STOP  00
      :401 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JSB,INPUT,AB

  FILE NAME-IPROGDA, DISP-INPUT , ID-AB
```

NOTE: The permanent file, ERRAN,1,NICHØLS is available for recall. It does not have to be recreated by rerunning this example.

The following run was used to analyze the TTY results previously stored on the file ERRAN. The generated table gives the errors in range contributed by the deviations caused by changing drag data, angle of elevation (THD), and initial muzzle velocity (VMX).

```
THIS IS IFSER
MODE- TTY OR BATCH - TTY
WILL THIS BE A NEW RUN, YES OR NO - NO
WHERE WERE RESULTS STORED,PFNAME,CV,ID- ERRAN,1,MICHAEL
0

                    RESULTS OF ERROR ANALYSIS
                    NOMINAL RANGE = 14740.00

   VARIABLE        NOMINAL          NOMINAL        STANDARD       RANGE
   PERTURBED       VALUE            VARIATION      DEVIATION      DEVIATIO
N
      T13            0.000            1.000          1.010       -68.348

      THD           30.000            2.000           .000       177.000

      VMX         2300.000           50.000          8.000        15.001

    END OF TTY RESULTS

    STOP 000
      .104 CP SECONDS EXECUTION TIME
COMMAND-
```

e. Example 5 shows the running of the Interior Ballistics Program (IB). Two new values of the propellant weight (PCI) are entered via the TTY as a temporary change to examine differences in muzzle velocity. Appendix K-5 shows the batch results. The TTY input necessary to produce this run is shown below.

```
THIS IS IBSHM
MODE- TTY OR BATCH -        TTY,IBS,S,R166IB

TITLE-
  PROJECTILE  8 INCH  M106

REQUEST(TAPE10,SPF)
REQUEST(TAPE9,SPF)

EXAMINE DATA BASE, YES OR NO -        YES

    SVN -       PCI
        P - 1     L- 0     N - 1
    VALUES -              8.000
    SVN -       END

MODIFY DATA, YES OR NO-     YES

    SVN,PLN-    PCI,002
     VALUES -   8.0,8.0
    SVN,PLN-    END

STORE MOD DATA, YES OR NO -NO

 INPUT/OUTPUT  OPTION  LIST
 (Y=1 N=0) TTY,80,TERM,CR -              00001100

CORE REQD- CM,T -180000,115

 COST CENTER-CHARGE CODE,
             XXX-XXX -                   000-700

    STOP  CR
    .400 CP SECONDS EXECUTION TIME
COMMAND- BATCH,300,INPUT,AO
```

f. Example 6 shows the running of the Lethal Area Program (LA), where two variables, burst height (PHB) and angle of fall (AOF), are linked by the L parameter discussed on page 9. Even though both variables have two values each, they are changed simultaneously (the permuted variable is PHB). This run also used the option to store the modified data in a permanent file called LAMØD2 (cycle 2) with the new title, "LA MØD2 8 IN PRØJECTILE". The batch output is shown in Appendix K-6. The TTY input is given below. Note that, in this example, the user initially typed the wrong symbol for the burst height. The system allows corrections as shown without aborting.

```
THIS IS IPSSM
MODE- TTY OR BATCH •        TTY,LA5,5,M106LA

TITLE•

  PROJECTILE  8 INCH  M106

 REQUEST(TAPE12,*PF)
 REQUEST(TAPE9,*PF)

 EXAMINE DATA BASE, YES OR NO •        NO

MODIFY DATA, YES OR NO•    YES

    SYM,PLN•      PBH,212

    PBH IS INCORRECT SYMBOL
    SYM,PLN•      PHB,212

     VALUES •     20.,25.

    SYM,PLN•      AOF,012

     VALUES •     47.,42.

    SYM,PLN•      END

STORE MOD DATA, YES OR NO •YES

NEW TITLE •       LA MOD2 8 IN PROJECTILE

WHERE DO YOU WISH TO STORE MOD DATA: CY,PFNAME •        2,LA
MOD2

     MOD DATA STORED:  CY • 2   PF • LAMOD2

 REQUEST(TAPE10,*PF)
 CT ID•  NICHOLS PFN•LAMOD2
 CT CY•  002   00001472 WORDS.:

 INPUT/OUTPUT  OPTION  LIST
 (Y=1 N=0) TTY,DB,TERM,CS •              00001100

CORE REQ•  CM,Y •120000,400

 COST CENTER-CHARGE CODE,
              XXX-XXX •                  800-700

     STOP  00
       1.885 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,AB
```

g. Example 7 illustrates the running of the Interior Ballistics Program (IB). Here the option of examining all values of the data base is utilized by typing the word ALL in answer to the question "EXAMINE DATA, YES ØR NØ =". TTY input is shown below, and batch output is given in Appendix K-7.

```
THIS IS IPSSM
MODE- TTY OR BATCH -        TTY,IB5,5,M106IB
TITLE-
  PROJECTILE  8 INCH  M106
 REQUEST(TAPE12,*PF)
 REQUEST(TAPE9,*PF)
 EXAMINE DATA BASE, YES OR NO -          YES
     SYM -        ALL

          SYM    PLN    VALUES
          DII    101        3.543
          XLI    101      156.000
          UOI    101      300.000
          MPI    101    50600.000
          PMI    101       12.650
          PCI    101        8.500
          PKI    101       17.000
          PUI    101        0.000
MODIFY DATA, YES OR NO-     NO

 INPUT/OUTPUT  OPTION  LIST
 (Y=1 N=0) TTY,DB,TERM,CS -              00001100
CORE REQD- CM,T -150000,115

 COST CENTER-CHARGE CODE,
              XXX-XXX -                  880-700

     STOP  00
        .293 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,AD
  FILE NAME-IPSM09C, DISP-INPUT , ID-AB
```

h. Example 8 illustrates the running of the Recoil Mechanism Design Program (RM). In this case, the option to examine results of the run (in summary) on the TTY is selected. Note that the value of the rise-fall time of the rod pull curve (TIR) is selected for initial printout when the results stored in RMD1 (cycle 2) are later retrieved (page 52). The data base for this run is located in TESTRM (cycle 1). Also, the recoil tables in RMTAB (cycle 1) must be specified. TTY input is shown below. Batch output is given in Appendix K-8.

```
THIS IS IPSSM
MODE- TTY OR BATCH •        TTY,RM6,1,TESTRM

TITLE•

  RECOIL MECHANISM TEST

 REQUEST(TAPE12,*PF)
 REQUEST(TAPE9,*PF)

 EXAMINE DATA BASE, YES OR NO •          NO

MODIFY DATA, YES OR NO•    NO

 INPUT/OUTPUT  OPTION  LIST
 (Y=1 N=0) TTY,DB,TERM,CS •              11001100

CORE REQD- CM,T •120000,110

TTY INPUT LIST- SYMBOLS •  TIR

SPECIFY PFNAME FOR TTY RESULTS-PFNAME,CY,ID•   RMD1,2,NICHOLS

CATALOG CYCLE WAS   2
RECOIL TABLES - PFNAME,CY,ID•
 CT ID•  NICHOLS PFN=RMD1
 CT CY• 002  00000128 WORDS.:RMTAB,1,NICHOLS

 COST CENTER-CHARGE CODE,
              XXX-XXX •                  888-700

     STOP  00
       .397 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,AD
```

The following run is necessary to retrieve the results stored in RMD1 (cycle 2) on the previous page. Note that the first line printed out contains the value of TIR, as requested when RMD1 was initially created.

```
THIS IS IPSSM
MODE- TTY OR BATCH -      TTY
WILL THIS BE A NEW RUN, YES OR NO -  NO
WHERE WERE RESULTS STORED,PFNAME,CV,ID-        RMD1,2,MICHOLS

  TIR        .010

1

 INPUT DATA

         .01000         .28300     60000.00000         .27000
                      10.38000         .24600         .06780
        26.00000       36.00000     7635.70000     32520.00000
                       .00310     5000.00000       11.25000
         .00100         .00100         .00200         .01000
                      2.00000         .05000        3.50000
        3.50000        0.00000     1000.00000        2.00000
                      60.00000        1.50000       85.00000
       77.00000


       PRNK1            TRS            TRL            PRNK
                       PRIN           PRNK2          DRCLR
     5000.00000        .00610          11E-03   100488.25138
                   71161.66198     2500.00000        3.12285

       DRCLP           UPRS           THRCLC         DRCLCO
                       URCLC           XLBO           DRECR
      4.66473      110.88446          .00027        5.70000
                   298.03500         50.58530        1.68500

       DRECP           THBLO          DRECCO          UPRS
                       THRECC          URECC           XLBO
      3.34555          .15000         0.00000       38.87543
                       .15613       110.14003       61.31585

         TBR            UBR             UP             ZR
                         ZTIP         OFFSET         URDUMY
      3.00190       343.01000     4488.00200     274445.61500
                   200245.45188         .00079       6752.00070

     END OF TTY RESULTS
     STOP  000
           .138 CP SECONDS EXECUTION TIME
COMMAND-
```

i. Example 9 illustrates the running of the 6-D Trajectory Program (TR). Here the data base is located in TRAJFLTR (cycle 3). Also, a file containing 6-D coefficients (TRDATA, cycle 1) must be specified. Note that the short format for entering CM and T values has been utilized. TTY input is shown below. Batch output is given in Appendix K-9.

```
THIS IS IPSSM
MODE- TTY OR BATCH =        TTY,TR5,3,TRAJFLTR
TITLE=
   XM 483 SPINNER   ALL DALE  BODY
 REQUEST(TAPE12,*PF)
 REQUEST(TAPE9,*PF)
 6D COEFFICIENTS - PFNAME,CV,ID=          TRDATA,1,NICHOLS

 EXAMINE DATA BASE, YES OR NO =         NO
MODIFY DATA, YES OR NO=    NO

 INPUT/OUTPUT  OPTION  LIST
 (Y=1 N=0) TTY,DB,TERM,CS =              00001100,150000,200

 COST CENTER-CHARGE CODE,
              XXX-XXX =                  280-700

     STOP  00
       .731 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,AD
  FILE NAME-IPSR05U, DISP-INPUT , ID-AD
```

j. Example 10 illustrates the running of the Sabot Design Program (SD), whose data base is located in SFRSD (cycle 1). Here the NPR parameter (Appendix 8) is set equal to 3.0, which is the option to obtain printer and Calcomp plots. The modified data are stored in PLOT (cycle 5) so that the graphs may be obtained again at a future date, if so desired (page 55). TTY input is shown below. Batch output, together with the Calcomp plot obtained, is given in Appendix K-10.

```
THIS IS IPSSM
MODE- TTY OR BATCH •        TTY,SD5,1,SFRSD
TITLE•
     SABOT DESIGN - SFR
 REQUEST(TAPE12,*PF)
 REQUEST(TAPE9,*PF)
 EXAMINE DATA BASE, YES OR NO •        NO
MODIFY DATA, YES OR NO•    YES
    SYM,PLN•      NPR,101
     VALUES •     3.0
    SYM,PLN•      END
STORE MOD DATA, YES OR NO •YES
NEW TITLE •       PRINTER & CALCOMP PLOTTING
WHERE DO YOU WISH TO STORE MOD DATA- CV,PFNAME •          5,PL
OT
     MOD DATA STORED-  CV • 5   PF • PLOT
 REQUEST(TAPE10,*PF)
 CT ID•  NICHOLS PFN•PLOT
 CT CV• 005  00000256 WORDS.:
 INPUT/OUTPUT  OPTION  LIST
 (Y=1 N=0) TTY,DB,TERM,CS •              00001100
CORE REQD- CM,T •150000,400
 COST CENTER-CHARGE CODE,
              XXX-XXX •                  500-700
     STOP  00
       .378 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,AB
  FILE NAME-IPSMOSN, DISP-INPUT
```

The following TTY run is necessary to obtain extra copies of the plots stored previously (page 54) on PLØT (cycle 5).

```
THIS IS IPSSM
MODE- TTY OR BATCH -        TTY,SD6,5,PLOT
TITLE-
  PRINTER & CALCOMP PLOTTING
 REQUEST(TAPE12,IPF)
 REQUEST(TAPE9,IPF)
 EXAMINE DATA BASE, YES OR NO -          YES
     SYM -        NPR
         P - 1     L- 0     N - 1
         VALUES -        3.000
     SYM -        END
MODIFY DATA, YES OR NO-     NO
 INPUT/OUTPUT  OPTION  LIST
 (Y=1 N=0) TTY,DB,TERM,CS -                  00001100
CORE REQD- CM,T -150000,000
 COST CENTER-CHARGE CODE,
              XXX-XXX -                      SD0-700
     STOP  00
       .000 CP SECONDS EXECUTION TIME
COMMAND-  BATCH,JOB,INPUT,AD
```

k. Example 11 shows the run necessary to retrieve the error analysis stored in the batch mode in ERROR (page 60).

```
THIS IS ERROR
MODE- TTY OR BATCH =      TTY
WILL THIS BE A NEW RUN, YES OR NO =  NO
WHERE WERE RESULTS STORED,PPNAME,SV,ID=      ERROR,3,MORRIS
S

                    RESULTS OF ERROR ANALYSIS
                    NOMINAL RANGE =  ERR=.04

  N   VARIABLE      NOMINAL          NOMINAL        STANDARD      RANGE
      PERTURBED     VALUE            VARIATION      DEVIATION     DEVIATIO

      T13             0.000            1.000          1.010     -104.819

      THO            20.000            2.000           .000      138.771

      WTK          2000.000           50.000          2.000       21.178

    END OF TTY RESULTS
    STOP 000
    .117 OF SECONDS EXECUTION TIME
COMMAND=
```

1. Example 12 illustrates the running of the Heppner Interior Ballistics Program (IH). In this case, the values of peak pressure (PEP) and muzzle velocity (VØM) are examined and subsequently modified. The option to store this modified data with a new title is selected here. TTY input is given below. Batch output is shown in Appendix K-11.

```
THIS IS IPSSM
MODE- TTY OR BATCH -        TTY,IHS,1,HEPIH
TITLE-
  HEPPNER-INTERIOR BALLISTICS
REQUEST(TAPE12,SPF)
REQUEST(TAPE9,SPF)
EXAMINE DATA BASE, YES OR NO -          YES
     SVN -        PEP
          P - 1    L- 0     N - 1
          VALUES - 60000.000
     SVN -        VOM
          P - 1    L- 0     N - 1
          VALUES - 5000.000
     SVN -        END
MODIFY DATA, YES OR NO-     YES
     SVN,PLN-     PEP
      VALUES -    59400.
     SVN,PLN-     VOM,101
      VALUES -    4850.
     SVN,PLN-     END
STORE MOD DATA, YES OR NO -YES
NEW TITLE -       EXPERIMENT IH
WHERE DO YOU WISH TO STORE MOD DATA- CV,PFNAME -          1,TE
MPIH
      MOD DATA STORED-  CV - 1   PF - TEMPIH
REQUEST(TAPE10,SPF)
CY ID-  NICHOLS PFN-TEMPIH
CY CV- 001  00000300 WORDS.
INPUT/OUTPUT  OPTION  LIST
(Y=1 N=0) TTY,SS,TERM,CS -              00001100,100000,000
COST CENTER-CHARGE CODE,
                XXX-XXX -               000-700
CONTROL CARDS WRITTEN
     STEP  05
     .420 CP SECONDS EXECUTION TIME
COMMAND- BATCH,JOB,INPUT,A0
  FILE NAME-IPSM04U, DISP-INPUT , ID-A0
```

C. Batch Examples

1. General Input Information

Section C, page 21 provides general instructions for running IPSSM in the batch mode. The examples below will show only the batch instruction cards necessary to run certain options. The complete set of control cards is given in pages 22,23.

2. Representative Batch Examples

a. Example 1 is the same run illustrated in Example 3 of the TTY runs. Note that the DATA card is used to change the key variable CGS from 3.315 (value in data base) to 3.50 and also to delete one value of WTS. Batch output shown in Appendix K-12 is identical with Appendix K-3. Batch instruction cards are shown below:

```
BATCH,SP5,5,M106SP

00001100,120000,115

DATA

WTS

200.

CGS

3.5

END
```

b. Example 2 shows the use of the TABLE card. This card is used to delete exterior ballistic tables before running the AR program. In the case below, Table 12 is deleted, since only phase 2 of the trajectory is to be run. Table 12 is used only if phase 1 is to be run. Appendix K-13 shows the output for this run.

NOTE: When rerunning examples 2c and 2d care should be taken to specify different permanent file names than 1,M106GRAPH and 2,TEST1 and ERROR,3 to avoid conflict and possible job abort.

```
BATCH,AR5,5,M106AR

00001100,120000,115

TABLE

12

END
```

c. Example 3 illustrates the use of setting up a data set compatible with the PROMS graphics program. The WT program is called for with the M106 data. The graphics data set is cataloged as M106GRAPH (cycle 1). Appendix K-14 shows the output for this run.

```
BATCH,WT5,5,M106WT

00001100,120000,115

GRAPHICS,1,M106GRAPH
```

d. Example 4 illustrates the use of the DATA, TABLE, and ERRØR cards in the AR program. Modified data are stored in TEST1 (cycle 2). Table 12 is also deleted. The ERRØR card stores error analysis results in ERRØR (cycle 3) for future teletype retrieval (page 56).Appendix K-15 shows the batch output for this run.

```
BATCH,AR5,5,M106AR

01001100,145000,210

DATA,2,TEST1

VMX,202

2500., 2700.

THD

30.

END

TABLE
```

```
12
END
ERRØR,3,NICHØLS
```

REFERENCES

1. J. Klappholz, "A Computer Program to Calculate the Weight and Stability Factor of a Shell", Technical Report 3537, Picatinny Arsenal, February 1967.

2. W.H. Bolte, "PROMS - PROjectile Measurement System Program", PROMS Report, Picatinny Arsenal, December 1973.

3. R.H. Whyte, "SPINNER - A Computer Program for Empirically Predicting the Aerodynamic Coefficients of Spin Stabilized Projectiles", Engineering Sciences Laboratory Report, Picatinny Arsenal, September 1968.

4. F. McMains, "Interior Ballistics - A Short Computer Program", Technical Report 3365, Picatinny Arsenal, April 1966.

5. R. Beck, "RKTCAN - A Two-Dimensional Trajectory Computer Program with Drag - Cancelling Option for One or Two - Stage Missiles Using a Flat Earth Model", Technical Memorandum 1851, Picatinny Arsenal, September 1968.

6. E.M. Friedman, "Description of the Revised AERO1 Program, PA No. 010417", Technical Memorandum 2151, Picatinny Arsenal, June 1974.

7. Control Data Corporation, Intercom Reference Manual, 6000 Version 3, 1971 (or newer versions as they become available).

8. Management Information Systems Directorate, "Digital Systems Handbook for Scientists and Engineers", Information Report Number 71-21, Picatinny Arsenal, (Updated through April 1973 or any later version).

9. John Nielsen, "Computer Program for Six-Degree-of-Freedom Missile Trajectories", Technical Memorandum 1292, Picatinny Arsenal, November 1963.

10. Andrew Semeister and John Zavada, "Studies in Flechette and Sabot Technology - Part 1: Slip Model for Single Flechette Sabot Assemblies, Part II: Axial Stress Model for Single Flechette Sabot Assemblies, ARMCOM-FA Report R-3006, 3007, April 1974.

11. L.D. Heppner, "Final Report of Special Study of an Electronic Computer Program for Interior Ballistics", Technical Report DPS-1711, Ballistic Research Laboratories, July 1965.

12. Management Information Systems Directorate, "Plotting Routines", Information Report 73-6, Picatinny Arsenal, (Updated through February 1973 or any later version).

13. Bruce Barnett, "Trajectory Equations for a Six-Degree-of-Freedom Missile Using a Fixed-Plane Coordinate System", Technical Report 3391, Picatinny Arsenal, June 1966.

APPENDIX A1

STATIC PROPERTIES CALCULATION PROGRAM (WT)

KEY VARIABLE INPUT

I. Number of Each Shell Item:

SYMBOL	VALUES OR FORMAT	MEANING
NBI	F10.4	Number of body items*
NOF	F10.4	Number of fins
NFP	F10.4	Number of fin pieces*
NKI	F10.4	Number of known items*
NOI	F10.4	Number of ogival items*

II. Control for Program Options:

SYMBOL	VALUES OR FORMAT	MEANING
WTC	0.0	Do weight calculation
	1.0	Do not do weight calculation
DRS	0.0	Provide shell drawing
	1.0	Do not provide shell drawing
STC	0.0	Do not do stability calculation
	1.0	Do stability calculation
	2.0	Supply volume of entire shell (VOW)
	3.0	Supply PIW, CGW, TIW
NAR	F10.4	Number of additional runs
DDC	1.0	Drawing of each change
COO	F10.4	Number of copies of output

*The total number of these items should correspond to the number of cards following the WGTTAB card referred to on page 26.

III. Additional Cards Required for Stability Calculation:

SYMBOL	VALUES OR FORMAT	MEANING
PIW	F10.4	Polar moment of inertia
CGW	F10.4	Center of gravity
TIW	F10.4	Transverse moment of inertia
VOW	F10.4	Volume
BDW	F10.4	Bore diameter
BAD	F10.4	Base diameter
TEW	F10.4	Temperature (degrees F)
TWW	F10.4	Twist
PVM	F10.4	Projectile velocity
COS	F10.4	Copies of stability output

APPENDIX A2

STATIC PROPERTIES CALCULATION PROGRAM (WT)

FORMAT OF SHELL ITEM INPUTS

Body Item Card:

Columns 1-10	D1, diameter on left
Columns 11-20	D2, diameter on right
Columns 21-30	H, length
Columns 31-40	R, density
Columns 41-50	BARX, distance from D1 surface to reference. If D1 is to the right of the reference, BARX is positive.
Columns 61-71	Identification
Column 72	If blank, then this element is not a part of the outer surface of the shell. If "1", then this element is a part of the outer surface of the shell. Column 72 must contain either a blank or a 1.

Fin Item Card:

Columns 1-10	FD1, radius on left
Columns 11-20	FD2, radius on right
Columns 21-30	FH, length
Columns 31-40	FR, density
Columns 41-50	FBARX, distance from FD1 surface to reference
Columns 51-60	FD, thickness of fin
Columns 61-71	Identification
Column 72	If blank, this element is not a part of outer volume. If "1", this element is part of the outer volume.

Known Item Card:

Columns 1-10	Weight
Columns 11-20	Polar inertia
Columns 21-30	Transverse inertia
Columns 31-40	Distance of CG to reference
Columns 41-50	Volume, if needed for column 72
Columns 61-71	Identification
Column 72	If 0, not outer volume. If "1", outer volume

Ogival Item Card:

Columns 1-10	GA, see Reference 1
Columns 11-20	GB, see Reference 1
Columns 21-30	GS, length of ogive
Columns 31-40	GRH, density
Columns 41-50	GREP, distance to reference
Columns 51-60	GRAD, radius of ogive
Columns 61-71	Identification
Column 72	If blank, no outer volume. If "L" outer volume

The dimension cards are included only for a weight calculation or a plot. If a stability calculation only is required, there will be no dimension cards.

APPENDIX B

AEROBALLISTIC COEFFICIENTS PROGRAM (SP)

KEY VARIABLE INPUT

I. Program Constants and Parameters

SYMBOL	VALUE OR FORMAT	MEANING
PLS	F10.4	Projectile length (calibers)
NLS	F10.4	Nose length (calibers)
BLS	F10.4	Boattail length (calibers)
CGS	F10.4	Distance of CG from nose (calibers)
DIS	F10.4	Diameter of shell (calibers)
AMS	F10.4	Axial moment of inertia ($lb\text{-}in^2$)
TMS	F10.4	Traverse moment of inertia ($lb\text{-}in^2$)
WTS	F10.4	Weight (lb)
TST	F10.4	Twist (caliber/turn)
BOS	F10.4	Boom length (calibers)

II. Program Options

SYMBOL	VALUE OR FORMAT	MEANING
STS	1.0	Calculate stability
	0.0	Do not calculate stability
ARS	1.0	Punch AERO I tables
	0.0	Do not punch AERO I tables

SYMBOL	VALUE OR FORMAT	MEANING
SLS	1.0	Punch SAUL 7 tables
	0.0	Do not punch SAUL 7 tables
N6S	1.0	Punch NOL6D tables
	0.0	Do not punch NOL6D tables
NGS	1.0	Punch graph output
	0.0	Do not punch graph output

APPENDIX C

INTERIOR BALLISTICS PROGRAM (IB)

KEY VARIABLE INPUT

SYMBOL	VALUES OR FORMAT	MEANING
DII	F10.4	Diameter of gun (inches)
XLI	F10.4	Length of projectile traveled (inches)
VOI	F10.4	Chamber volume (cubic inches)
MPI	F10.4	Maximum pressure (psi)
PMI	F10.4	Projectile weight (lb)
PCI	F10.4	Propellant weight (lb)
PKI	F10.4	Propellant type (code)
MVI	F10.4	Muzzle velocity (fps)

NOTE:

One of the above values must remain zero in order for the interior ballistics to execute properly. The parameter that is set initially to zero is variable to be calculated. Thus, seven of the above eight variables require data input.

APPENDIX D1

EXTERIOR BALLISTICS PROGRAM (AR)

KEY VARIABLE INPUT

I. Phase Options:

SYMBOL	VALUES OR FORMAT	MEANING
NX1	1.0	Compute Phase I
	0.0	Do not compute Phase I
NX2	1.0	Compute Phase II
	0.0	Do not compute Phase II
NX3	1.0	Compute Phase III
	0.0	Do not compute Phase III
NX4	1.0	Compute Phase IV
	0.0	Do not compute Phase IV

II. Initial Conditions and Constants:

SYMBOL	VALUES OR FORMAT	MEANING
THD	F10.4	Quadrant elevation (Q.E.) (degrees)
VMX	F10.4	Initial velocity (ft/sec)
WGT	F10.4	Missile weight (lb)
DIA	F10.4	Diameter (inches) of projectile
XIN	F10.4	Initial range (ft)
YIN	F10.4	Initial altitude (ft)
TIN	F10.4	Initial time (sec)
TWS	F10.4	Effective gun twist (1/25 use 25.0, etc.)

SYMBOL	VALUES OR FORMAT	MEANING
YLA	F10.4	Launcher length (ft)
DEL	F10.4	Integration increment (sec)
SDT	F10.4	Initial spin rate (rad/sec)
YFA	F10.4	Terminal altitude (ft) on descent of trajectory
FFA	F10.4	Factor used for temperature variations
CKD	F10.4	Constant drag coefficient(Only necessary when KDC=2.0)
FCT	F10.4	Form factor for all drag tables. This value may be left blank when form factor is unity.
BIA	F10.4	Sustaining thrust (lb) in addition to that which is necessary to overcome drag. (Use only when CAN=1.0).
TK1	F10.4	Constant rolling moment (lb-ft) during Phase I.
TK2	F10.4	Constant rolling moment (lb-ft) during Phase II.
TK3	F10.4	Constant rolling moment (lb-ft) during Phase III.

SYMBOL	VALUES OR FORMAT	MEANING
TK4	F10.4	Constant rolling moment (lb-ft) during Phase IV

III. Phase I and III Options:

SYMBOL	VALUES OR FORMAT	MEANING
NTH	1.0	Use variable thrust
	2.0	Use constant thrust
MXX	1.0	Use variable burning rate
	2.0	Use constant burning rate

IV. Phase I Options:

SYMBOL	VALUES OR FORMAT	MEANING
THR	F10.4	Constant thrust value (lb) for Phase I (NTH = 2.0)
DTM	F10.4	Constant burning rate (lb-sec) during Phase I (MXX = 2.0)
BWT	F10.4	Booster weight (lb): weight of metal parts that are dropped off immediately following burnout in Phase I.

V. Phase III Options:

SYMBOL	VALUES OR FORMAT	MEANING
TH2	F10.4	Constant thrust value (lb) for Phase III (NTH = 2.0)
DT2	F10.4	Constant burning rate (lb/sec) during Phase III (MXX = 2.0)

VI. Time Constants for Each Phase:

SYMBOL	VALUES OR FORMAT	MEANING
TM1	F10.4	Time in seconds at end of completion of Phase I.
TM2	F10.4	Time in seconds at end of completion of Phase II.
TM3	F10.4	Time in seconds at end of completion of Phase III.
TM4	F10.4	Time in seconds at end of completion of Phase IV.
DL1	F10.4	Integration increment (sec) for Phase I.
DL2	F10.4	Integration increment (sec) for Phase II.
DL3	F10.4	Integration increment (sec) for Phase III.
DL4	F10.4	Integration increment (sec) for Phase IV.

SYMBOL	VALUES OR FORMAT	MEANING
DW1	F10.4	Printout interval (sec) for Phase I
DW2	F10.4	Printout interval (sec) for Phase II
DW3	F10.4	Printout interval (sec) for Phase III
DW4	F10.4	Printout interval (sec) for Phase IV

VII. Program Options:

SYMBOL	VALUES OR FORMAT	MEANING
KDC	1.0	Use variable drag coefficients
	2.0	Use constant drag coefficients
KTH	1.0	Input magnus force and magnus center of pressure coefficients
	2.0	Input magnus moment coefficients
NUN	1.0	Output given in feet
	2.0	Output given in meters
JZN	F5.1	Number of trajectories to be computed
NJR	F5.1	Number identifying first trajectory run in the set specified by JZN

SYMBOL	VALUES OR FORMAT	MEANING
ISP	0.0	Compute spin and stability calculation
	1.0	Perform only spin calculations
	2.0	Omit spin and stability inputs (Tables I thru II)
IAX	F5.1	Frequency of stability calculations in terms of printout (Example - if it is desired to have stability calculations every third printout, set IAX equal to 3.0)
NOR	XX.X	Number of time points entered in the "G-Norm" Table
NAT	F5.1	Number of nonstandard altitudes, temperatures and densities to be entered (NAT is set equal 0.0 if 1959 ARDC standard atmosphere is to be used)
CAN	1.0	Cancel drag
	2.0	Do not cancel drag

VIII. Constant Factors for Table Changes:

SYMBOL	VALUES OR FORMAT	MEANING
T12	0.0 or 1.0 F10.4	No change to Table 12 Multiply all dependent variable values by the given constant

SYMBOL	VALUES OR FORMAT	MEANING
T13	0.0 or 1.0 F10.4	No change to Table 13 Multiply all dependent variable values by the given constant

NOTE: Symbols T14 through T18 perform the same function for Tables 14 through 18, respectively, as T12 and T13 described above.

IX. Factors Used in Error Analysis (See Example 4):

SYMBOL	VALUES OR FORMAT	MEANING
13P	X.XXX	Nominal variation factor for Drag Table 13
THP	XX.XXX	Nominal variation factor for the Thrust (THD)
VMP	XXX.XX	Nominal variation factor for the Initial Velocity (VMX)
13D	X.XXX	Standard deviation factor for Drag Table 13
TSD	XX.XXX	Standard deviation factor for the Thrust (THD)
VSD	XXX.XX	Standard deviation factor for the Initial Velocity (VMX)

X. Constants Used to Plot Trajectory Output:

SYMBOL	VALUES OR FORMAT	MEANING
NSY	33.0 =	Code numbers defining symbol to be plotted at data points. For a complete listing, see Reference 6.
	54.0 =	
	12.0 =	
	16.0 =	
	14.0 =	
NPL	1.0	Plot trajectory
	0.0	Do not plot trajectory
DXG	XX.X	Number of Range Units (feet or meters) per inch on the X-axis of the graph
DYG	XX.X	Number of Altitude Units on the Y-axis of the graph

APPENDIX D2

EXTERIOR BALLISTICS PROGRAM (AR)

LIST OF TABLES

TABLE NUMBER	MEANING
1	Roll damping coefficients vs. mach no.
2	Roll moment coefficients vs. mach no.
3	Normal force coefficients vs. mach no. (Omit when ISP = 1. or 2.)
4	Normal centers of pressure (calibers from nose) vs. mach no. (Omit when ISP = 1. or 2.)
5	Magnus moment coefficients vs. mach no. (Omit when either ISP = 1. or when KTH = 1.)
6	Magnus force coefficient vs. mach no. (Omit when either ISP = 1. or when KTH = 2.)
7	Magnus centers of pressure (calibers from nose) vs. mach no. (Omit when either ISP = 1. or when KTH = 2.)
8	YAW damping moment coefficients vs. mach no. (Omit when ISP = 1.)
9	Centers of gravity (calibers from nose) vs. time. (Omit when ISP = 1.)
10	Transverse moment of inertia ($lb\text{-}ft^2$) vs. time. (Omit when ISP = 1.)
11	Axial moment of inertia ($lb\text{-}ft^2$) vs. time.
12	Drag coefficients vs. mach. no. for Phase I. (Omit when either NX1 = 0. or when KDC = 2.)
13	Drag coefficients vs. mach no. for Phases II and IV. (Omit when either NX2 = 0. and NX4 = 0. or when KDC = 2.)

TABLE NUMBER	MEANING
14	Drag coefficients vs. mach no. for Phase III. (Omit when either NX3 = 0. or KDC = 2.)
15	Thrust (lb) vs. time for Phase I. (Omit when either NX1 = 0. or NTH = 2.)
16	Missile weight (lb) vs. time for Phase I. (Omit when either NX1 = 0. or MXX = 2.)
17	Thrust (lb) vs. time for Phase III. (Omit when either NX3 = 0. or NTH = 2.)
18	Missile weight (lb) vs. time for Phase III. (Omit when either NX3 = 0. or MXX = 2.)
19	Altitude (ft) vs. temperature in degrees Rankine (Omit when NAT = 0.)
20	Altitude (ft) vs. density (lb-sec^2/ft^4).
21	Normal acceleration in "g's" vs. time (Omit if NOR = 0.)

NOTE: The same increments in altitude must be used in Tables 19 and 20.

APPENDIX E

TERMINAL EFFECTIVENESS PROGRAM (LA)

KEY VARIABLE INPUT

I. Terminal Conditions and Constants:

SYMBOL	VALUES OR FORMAT	MEANING
PHB	F10.4	Burst height (feet)
AOF	F10.4	Angle of fall (degrees)
TVM	F10.4	Terminal velocity (ft/sec)
COR	F10.4	Scale factor to correct for total fragment weight (set to 0.0 if no factor is to be used.)
NOZ	F10.4	Number of fragmentation zones

II. Lethal Area Computation Options:

SYMBOL	VALUES OR FORMAT	MEANING
TRP	0.0	Use Simpson's Rule Integration.
	1.0	Use Trapezoidal Rule
NQA	3.0	Compute lethal areas for foxhole and prone targets only.
	2.0	Compute lethal areas for standing, foxhole, and prone targets only
	1.0	Compute lethal areas for standing, foxhole, prone and the six-point standing target
SKP	1.0	Lethal areas are computed as defined by NQA stated above
	2.0	If NQA = 1.0, compute standing target lethal area only; if NQA = 2.0, compute six-point standing target lethal area only

III. Lethal Area Cut-Off Options:

SYMBOL	VALUES OR FORMAT	MEANING
BET	F10.4	Cutoff angle (degrees)
COP	1.0	Use constant cutoff velocity (CVL)
	2.0	Compute cutoff velocity for each weight group using constant shape factor (CKQ)
	3.0	Compute cutoff velocity for each weight group using constant A/M value (AQM)
CVL	F10.4	Constant cutoff velocity
	0.0	No cutoff mass used
RMC	F10.4	Constant mass cutoff (used if nonzero value is entered)

IV. Fragment Blast Option:

SYMBOL	VALUES OR FORMAT	MEANING
BLT	0.0	Blast effects are not included
	1.0	Use blast radii
RB1	F10.4	First blast radius
RB2	F10.4	Second blast radius (RB2 must be greater than RB1)

V. Fragment Drag Options:

SYMBOL	VALUES OR FORMAT	MEANING
CCK	0.0	Compute shape factor given C12 and AMB
	1.0	Use shape factor (CKQ)

CKQ	F10.4	Shape factor
C12	F10.4	Constant to determine shape factor
AMB	F10.4	Average value of A/M
NCD	F10.4	Number of values in drag vs. velocity table (must be equal to or greater than two)

VI. Casualty Criteria Options:

SYMBOL	VALUES OR FORMAT	MEANING
ABC	0.0	Use casualty index value
	1.0	Enter AXC, BXC, CXC values
NCC	XX.X	Casualty criteria index
AXC	F10.4	Casualty criteria constant
BXC	F10.4	Casualty criteria constant
CXC	F10.4	Casualty criteria constant

VII. Print and Punch Options:

SYMBOL	VALUES OR FORMAT	MEANING
IOU	0.0	Do not print zone data output
	1.0	Print zone data output
NDL	1.0	Print PK arcs vs. range (If matrix is to be generated CLS must also be equal to 1.0)
	2.0	Do not print
CLS	0.0	Do not print
	1.0	Print PK arcs vs. range if matrix is to be generated

NT7	1.0	Print and Punch avg PK vs. range
	2.0	Do not print or punch
	3.0	Print avg PK vs. range

VIII. Matrix Options:

SYMBOL	VALUES OR FORMAT	MEANING
MAT	0.0	Do not compute matrix
	1.0	Compute matrix
NDG	F10.4	Number of cells in deflection
NRG	F10.4	Number of cells in range
RAD	1.0	Use cell size in range and deflection and matrix center (RAM, DAM and CNT)
	2.0	Compute cell size based on maximum effective range
	3.0	Use cell size in range and deflection directions. RAX, DAY, DAX number of cells based upon maximum range.
DAM	F10.4	Cell size in deflection Used with RAD = 1.0
RAM	F10.4	Cell size in range Used when RAD = 1.0
CNT	F10.4	Center of matrix Used when RAD = 1.0
DAY	F10.4	Cell size in deflection Used when RAD = 3.0
RAX	F10.4	Cell size in range Used when RAD = 3.0

MCT	0.0	Insures at least two arcs cutting each cell of probability of kill matrix
	F10.4	Specifies given number of cuts in each cell of matrix
OSK	0.0	Do not punch matrix cards
	1.0	Punch matrix cards

IX. Target Posture for Matrix:

SYMBOL	VALUES OR FORMAT	MEANING
IN2	0.0	Do not compute matrix for ORO foxhole
	1.0	Compute matrix for ORO foxhole
IN4	0.0	Do not compute matrix for BRL prone
	1.0	Compute matrix for BRL prone
IN7	0.0	Do not compute matrix for one-point standing target
	1.0	Compute matrix for one-point standing target
IN8	0.0	Do not compute matrix for six-point standing target
	1.0	Compute matrix for six-point standing target

NOTE: Only one of the above postures may be selected for any given computer run.

APPENDIX F

6-D TRAJECTORY PROGRAM (TR)

KEY VARIABLE INPUT

I. Control Parameters:

SYMBOL	VALUES OR FORMAT	MEANING
NER	1.0	Flat earth.
	2.0	Spherical earth.
ROT	1.0	Rotating earth.
	2.0	No earth rotation.
NWD	1.0	Include wind tables.
	2.0	Do not include wind tables.
NKC	1.0	Use "k" coefficients.
	2.0	Use "c" coefficients.
NIR	1.0	Include atmosphere table.
	2.0	Use standard atmosphere.
MAL	1.0	Use cutoff at max. alt.
	2.0	Use no cutoff at max. alt.
NKS	1.0	Print coefficient tables.
	2.0	Do not print coefficient tables.
KFC	1.0	Include magnus (force) coefficients as input.
	2.0	Do not include magnus coefficients as input.
KPC	1.0	Include roll moment coefficients.
	2.0	Do not include roll moment coefficients.
KZC	1.0	Include (yaw) roll damping coefficients.

	2.0	Do not include (yaw) roll damping coefficients.
KCM	1.0	Include magnus force C.P.
	2.0	Do not include magnus force C.P.
NTV	0.0	Use table of thrust vs. time
	1.0	Use table of thrust vs. altitude.
KTP	1.0	Punch card output for PMTASS input.
	0.0	Do not punch card output.
KON	0.0	Assume KFC input to be based on $\pi/16$
	1.0	Assume KFC input to be based on $\pi/8$.
KMR	0.0	Print output in feet.
	1.0	Print output in meters.
KSP	1.0	For three-way table lookup of KFC and CPF. KFC and CPF will now be a function of mach no., angle of attack, and spin.
	0.0	For two-way table lookup of KFC and CPF.
NTA	24.0	Number of entries in atmosphere table. Default value is 24.0.
NIW	40.0	Number of entries in wind table. Default value is 40.0.
NAX	F10.4	Max. number of angle of attack arguments in coefficients.
NMX	F10.4	Max. number of mach number arguments.

NUR	F10.4	Number of trajectories to be computed using same control parameters, atmosphere, thrust, wind, and ballistic coefficients.
NRU	F10.4	Starting number of trajectories indicated by NUR above.
NNW	F10.4	Number of range values in wind tables (max. 40). NOTE: 40 altitudes must be given for each range value.
NSP	F10.4	Max. number of spin variables to be supplied when KSP=1.0.
DMA	F10.4	Max. time interval (DLT max.).
	0.0	Set DLT min. = 0.00005.
DMI	F10.4	Min. time interval (DLT min.).
	0.0	Set DLT min. = 0.5.

II. Phase Options:

SYMBOL	VALUES OR FORMAT	MEANING
N1X	0.0	Do not compute Phase I.
	1.0	Compute Phase I.
N2X	0.0	Do not compute Phase II.
	1.0	Compute Phase II.
N3X	0.0	Do not compute Phase III.
	1.0	Compute Phase III.
N4X	0.0	Do not compute Phase IV.
	1.0	Compute Phase IV.
N5X	0.0	Do not compute Phase V.
	1.0	Compute Phase V.

N6X	0.0	Do not compute Phase VI.
	1.0	Compute Phase VI.
N7X	0.0	Do not compute Phase VII.
	1.0	Compute Phase VII.

III. Initial Conditions:

SYMBOL	VALUES OR FORMAT	MEANING
ANA	F10.4	Longitude (degrees).
ANB	F10.4	Latitude (degrees).
AZI	F10.4	Azimuthal heading (degrees).
QEL	F10.4	Angle of elevation (degrees).
XOT	F10.4	Initial displacement (feet or meters).
YOT	F10.4	Initial altitude (feet or meters).
TAS	F10.4	Time at start (seconds).
AKN	F10.4	Multiplies air densities by this factor (0.0 is read as 1.0).
DTR	F10.4	Diameter (inches).
WTR	F10.4	Weight (pounds).
VXP	F10.4	V_X feet per second.
VYP	F10.4	V_Y feet per second.
VZP	F10.4	V_Z feet per second.
SPT	F10.4	Missile spin rate (rad/sec).
WYP	F10.4	Pitch rate (rad/sec).
WZP	F10.4	Yaw rate (rad/sec).

CIX	F10.4	Booster initial I_X (axial moment, lb-sq in).
CIY	F10.4	Booster initial I_Y (transverse moment, lb-sq in).
XCG	F10.4	Booster initial center of gravity from nose (inches).
PUB	F10.4	Booster specific impulse (lb-sec/lb fuel).
WDT	F10.4	Booster burning rate (lb-fuel/ sec).
CX2	F10.4	Booster final I_X (axial moment lb-sq in).
CY2	F10.4	Booster final I_Y (transverse moment, lb-sq in).
CG2	F10.4	Booster final center of gravity (inches).
ANO	F10.4	Booster nozzle diameter (inches).
AMA	F10.4	Booster mal. angle, $_A$ (degrees).
TMA	F10.4	Booster mal. angle, $_T$ (degrees).
RXT	F10.4	Booster mal. distance, R_X (inches).
RYT	F10.4	Booster mal. distance, R_Y (inches).
RZT	F10.4	Booster mal. distance, R_Z (inches).
TKA	F10.4	Booster jet torque moment (inches).
TMD	F10.4	Booster thrust modifier.
CXS	F10.4	Main stage initial I_X (lb-sq in).
CYS	F10.4	Main stage initial I_Y (lb-sq in).
CGM	F10.4	Main stage initial center of gravity (inches).

PUS	F10.4	Main stage specific impulse (lb-sec/lb).
WRS	F10.4	Main stage burning rate (lb/sec).
CX6	F10.4	Main stage final I_X (lb-sq in).
CY6	F10.4	Main stage final I_Y (lb-sq in).
CG6	F10.4	Main stage final center of gravity (inches).
DO5	F10.4	Main stage nozzle diameter (inches).
AL5	F10.4	Main stage mal. angle, $_A$ (degrees).
TL5	F10.4	Main stage mal. angle, $_T$ (degrees).
RX5	F10.4	Main stage mal. distance, R_X (degrees).
RY5	F10.4	Main stage mal. distance, R_Y (inches).
RZ5	F10.4	Main stage mal. distance, R_Z (inches).
TK5	F10.4	Main stage jet torque arm (inches).
TM5	F10.4	Main stage thrust modifier.
TI1	F10.4	Time at end of Phase I (seconds).
TI2	F10.4	Time at end of Phase II (seconds).
TI3	F10.4	Time at end of Phase III (seconds).
TI4	F10.4	Time at end of Phase IV (seconds).
TI5	F10.4	Time at end of Phase V (seconds).
TI6	F10.4	Time at end of Phase VI (seconds).
WT5	F10.4	Initial main stage weight (pounds).

BRB	F10.4	Burning rate at separation (lb/sec).
FF1	F10.4	Phase I form factor drag.
FF2	F10.4	Phase II form factor drag.
FF3	F10.4	Phase III form factor drag.
FF4	F10.4	Phase IV form factor drag.
FF5	F10.4	Phase V form factor drag.
FF6	F10.4	Phase VI form factor drag.
FF7	F10.4	Phase VII form factor drag.
ST5	F10.4	Separation thrust (pounds).

IV. Integration and Print Options:

SYMBOL	VALUES OR FORMAT	MEANING
DI1	F10.4	Phase I integration step size (seconds).
DI2	F10.4	Phase II integration step size (seconds).
DI3	F10.4	Phase III integration step size (seconds).
DI4	F10.4	Phase IV integration step size (seconds).
DI5	F10.4	Phase V integration step size (seconds).
DI6	F10.4	Phase VI integration step size (seconds).
DI7	F10.4	Phase VII integration step size (seconds).

DAZ	F10.4	Diameter (in.) of second stage. If left blank will be assumed= DTR
DS1	F10.4	Phase I output spacing (seconds).
DS2	F10.4	Phase II output spacing (seconds).
DS3	F10.4	Phase III output spacing (seconds).
DS4	F10.4	Phase IV output spacing (seconds).
DS5	F10.4	Phase V output spacing (seconds).
DS6	F10.4	Phase VI output spacing (seconds).
DS7	F10.4	Phase VII output spacing (seconds).
SPZ	F10.4	Spin rate of second stage. If left blank, SPT will be assumed to be that which existed at end of last phase.

V. Constants and Parameters:

SYMBOL	VALUES OR FORMAT	MEANING
PRS	F10.4	Static test atmospheric pressure (lb/sq in).
VWX	F10.4	Constant range wind (feet/sec).
VWY	F10.4	Constant cross-range wind (feet/sec).
VWZ	F10.4	Constant vertical wind (feet/sec).
IYO	F10.4	Initial deflection (feet).
TZF	F10.4	Terminal altitude (feet).
COD	F10.4	CODE (three numeric characters to identify job - are printed out).

APPENDIX G

RECOIL MECHANISM DESIGN PROGRAM (RM)

KEY VARIABLE INPUT

I. Program Options:

SYMBOL	VALUES OR FORMAT	MEANING
XND	0.0	Run next set of input data
	1.0	Do not run next set of input data
PRT	0.0	Print auxiliary output data
	1.0	Do not print auxiliary output data
ISW	0.0	Switch to bypass namelist

II. Constants and Parameters :

SYMBOL	VALUES OR FORMAT	MEANING
TIR	F10.4	Rise-fall time of rod pull curve (sec)
RH1	F10.4	Density of primary material-steel ($lb/in.^2$)
SIG	F10.4	Allowable stress in primary material ($lb/in.^2$)
RH2	F10.4	Density of secondary material-bronze ($lb/in.^3$)
XMR	F10.4	Mass of recoiling parts-initially the mass of gun tube and components (in-slug).
XMP	F10.4	Mass of projectile (in-slug).
XMC	F10.4	Mass of propelling charge (in-slug)
RSR	F10.4	Design recoil length-short (in.)
RLR	F10.4	Design recoil length-long (in.)
XIR	F10.4	Net impulse imparted (lb-sec)

SYMBOL	VALUES OR FORMAT	MEANING
VOR	F10.4	Projectile muzzle velocity (in./sec)
ALP	F10.4	Time to centroid of breech force (sec)
PMX	F10.4	Design fluid pressure-recoil ($lb/in.^2$)
DGT	F10.4	Diameter of gun tube at breech (in.)
DR1	F10.4	Allowable expansion (recoil)
DR2	F10.4	Allowable expansion (C $\leq$ recoil inner)
DR3	F10.4	Allowable expansion (C $\leq$ recoil outer)
DLM	F10.4	Allowable deflection (breech ring)
XNR	F10.4	Number of recoil cylinders
CDR	F10.4	Discharge coefficient for recoil
SC1	F10.4	Stress concentration for threaded members
SC2	F10.4	Stress concentration for grooves and thread reliefs
OVS	F10.4	Allowable difference in size between recoil and C $\leq$ recoil
DLP	F10.4	Increment of design fluid pressure ($lb/in.^2$)
CLR	F10.4	Clearance between gun tubes and cylinders (in.)
TRU	F10.4	Height from floor to trunnions (in.)

SYMBOL	VALUES OR FORMAT	MEANING
BAL	F10.4	Thickness of rotor for ballistic protection (in.)
CMT	F10.4	Distance from front (muzzle end) of breech to gun tube center of gravity (in.)
ROF	F10.4	Distance from floor to roof in cab (in.)
PGS	F10.4	Starting value of maximum gas pressure ($lb/in.^2$)

APPENDIX H

SABOT DESIGN PROGRAM (SD)

KEY VARIABLE INPUT

I. Program Options:

SYMBOL	VALUES OR FORMAT	MEANING
SOC	0.0	Segments of sabot are open
	1.0	Segments of sabot are closed
GFC	0.0	Rear geometry is cylinder
	1.0	Rear geometry is frustrum
NPR	1.0	Printer plotting
	2.0	CALCOMP plotting
	3.0	Printer and CALCOMP plotting

II. Constants and Parameters

SYMBOL	VALUES OR FORMAT	MEANING
PKP	F10.4	Peak pressure (PSI)
PFW	F10.4	Projectile-flechette weight (lb)
KK1	F10.4	Percentage head friction
CCF	F10.4	Percentage rear strut friction
NNS	F10.4	Number of sabot segments
WOB	F10.4	Weight of obturator (lb)
FRB	F10.4	Major frustrum radius (in.)
FRL	F10.4	Minor frustrum radius (in.)
LFR	F10.4	Length of frustrum (in.)
RVB	F10.4	Volume of rear section - 0.0 is meaningless ($in.^3$)
FVH	F10.4	Volume of sabot head ($in.^3$)

SPS	F10.4	Sabot material density (lb/in^3)
THK	F10.4	Thickness of rear strut (in.)
PFD	F10.4	Diameter of projectile (in.)
MBD	F10.4	Mean diameter between lands and grooves of bore (in.)

APPENDIX I

HEPPNER-INTERIOR BALLISTICS (IH)

KEY INPUT VARIABLES

I. Program Options:

SYMBOL	VALUES OR FORMAT	MEANING
ICK	F10.4	Plotting parameter for subroutine SYMBØL (angle at which text is to be printed - see Reference 11).
IPL	1.0	Printout only
	2.0	Plot only
	3.0	Printout and plot
RNS	F10.4	Number of runs
ZLI	F10.4	Number of lines between typeout.

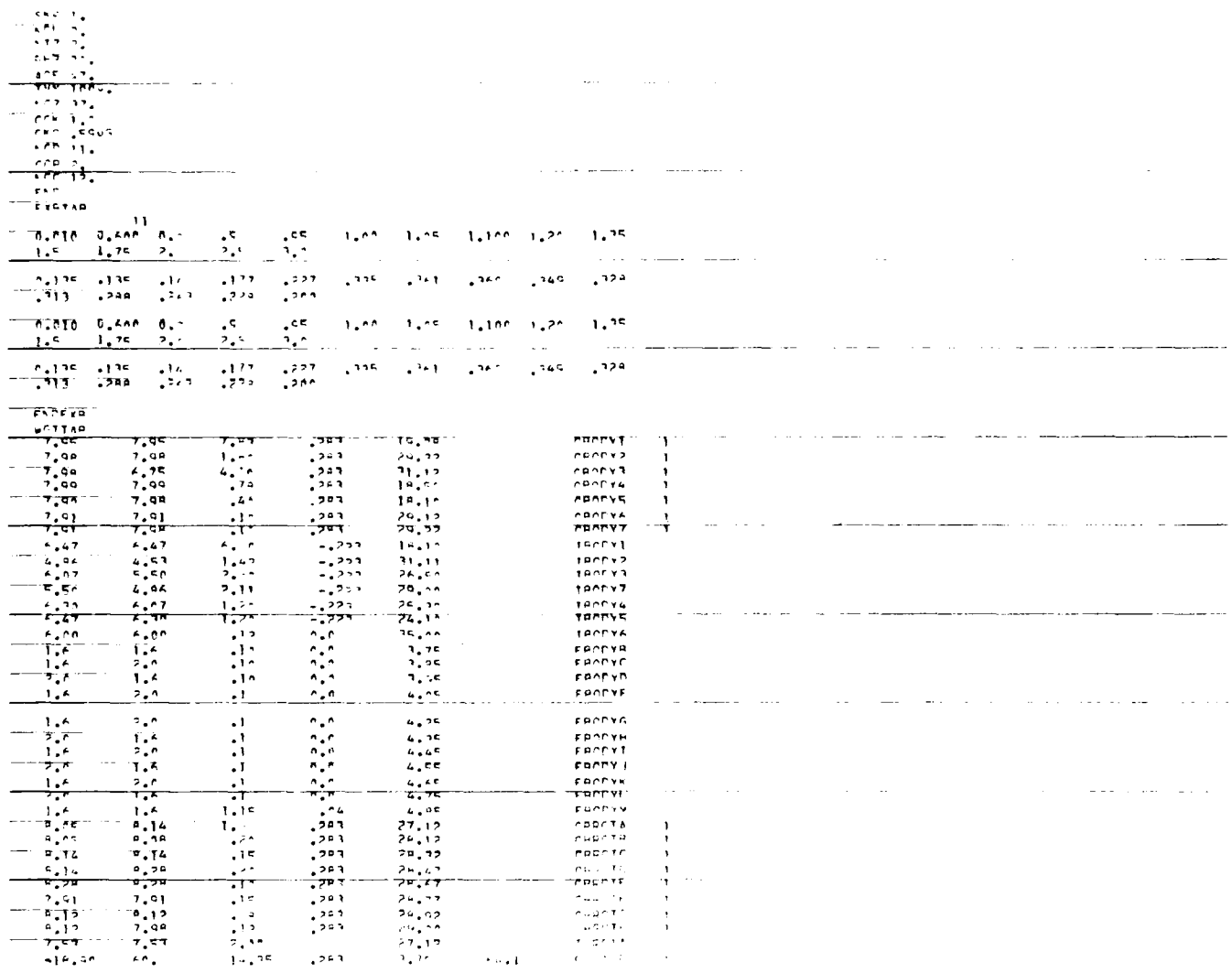
II. Constants and Parameters:

SYMBOL	VALUES OR FORMAT	MEANING
PEP	F10.1	Peak pressure (PSI)
VOM	F10.1	Muzzle velocity (ft/in^2)
CHV	F8.3	Chamber volume (in^3)
CSA	F8.3	Cross-section of bore (in^2)
WTG	F8.2	Weight of gun and recoiling parts (lb)
DST	F8.3	Distance travelled along tube (in.)
PWT	F8.3	Projectile weight (lb)
SER	F8.4	Specific energy ratio
INP	F8.3	Initial pressure (PSI)
AFQ	F8.6	Adjustment factor for Q
AFR	F8.6	Adjustment factor for R

PRF	F8.3	Pressure factor
TP1	F10.4	Type of propellant
CW1	F10.4	Weight (lb)
WB1	F10.4	Web (in.)
TP2	F10.4	Type of propellant
CW2	F10.4	Weight (lb)
WB2	F10.4	Web (in.)
TP3	F10.4	Type of propellant
CW3	F10.4	Weight (lb)
WB3	F10.4	Web (in.)
TP4	F10.4	Type of propellant
CW4	F10.4	Web (in.)
WB4	F10.4	Web (in.)

APPENDIX J

IPSDATA SAMPLE OUTPUT



-10.50	60.	3.75	.1	0.0	43.0	FOOTVE
	-T.25	1.0	-.229	37.59	1.0	TCUBVE
FACTOR FOOTSE						
0.000	2.500	1.250	2150.000	2364.667	2150.000	1.000
1.000						
0.000						
5.000	7.500	5.000	2364.667	2578.333	2800.000	1.000
1.000						
0.000						
7.500	12.500	10.000	2575.000	2335.000	2350.000	1.000
1.000						
0.000						
12.500	17.500	15.000	2335.000	2350.000	2300.000	1.000
1.000						
0.000						
17.500	22.500	20.000	2850.000	3100.000	3400.000	1.000
1.000						
0.000						
22.500	27.500	25.000	3100.000	2900.000	2900.000	1.000
1.000						
0.000						
27.500	32.500	30.000	2500.000	3100.000	3000.000	1.000
1.000						
0.000						
32.500	37.500	35.000	3100.000	3275.000	3200.000	1.000
.176						
33.708						
37.500	42.500	40.000	3275.000	3450.000	3350.000	2.000
.008	1.462					
31.321	7.835					
42.500	47.500	45.000	3450.000	3550.000	3550.000	2.000
.160	5.065					
36.480	5.784					
47.500	52.500	50.000	3550.000	4200.000	3550.000	4.000
.225	1.351	1.724	30.348			
19.043	9.517	9.517	9.517			
52.500	57.500	55.000	4200.000	4200.000	4850.000	4.000
.312	1.441	2.053	50.401			
46.993	9.487	9.487	9.487			
57.500	62.500	60.000	4200.000	3375.000	3550.000	7.000
.139	1.738	2.494	7.454	9.070	43.778	973.973
141.195	9.466	18.982	9.466	18.982	18.982	9.466
62.500	67.500	65.000	3375.000	3350.000	3200.000	11.000
.217	1.432	3.284	7.297	10.941	16.163	26.568
45.807	93.441	100.095	214.318			
113.791	9.466	18.982	9.466	9.466	28.448	9.466
18.982	9.466	9.466	9.466			
67.500	72.500	70.000	3350.000	3625.000	3500.000	17.000
.127	1.594	2.851	13.833	19.498	26.000	40.267
82.934	92.772	109.445	141.429	171.171	234.882	259.258
390.390	487.488	549.541				
179.971	18.948	9.474	9.474	9.474	9.474	28.423
9.474	9.474	18.948	18.948	9.474	18.948	9.474
9.474	9.474	9.474				
73.508	77.500	75.000	3625.000	3825.000	3750.000	13.000
.097	1.519	2.858	5.505	9.841	13.812	30.713
47.763	183.163	172.171	232.888	438.438	571.000	
180.038	37.892	37.892	9.462	9.462	9.462	37.892
9.462	9.462	9.462	28.429	9.462	28.429	
77.500	82.500	80.000	3825.000	4200.000	3900.000	18.000
.234	1.548	3.154	7.299	9.771	11.000	16.225
33.342	30.795	43.042	57.778	78.261	113.667	179.000
445.282	827.738	1117.575	2428.424			
246.389	37.886	47.358	9.471	18.943	28.415	9.471

16,543	33,116	47,356	0.471			
87,500	87,500	35,000	4200.000	4500.000	4500.000	16.000
.152	1,523	3,501	6,163	13,778	31,225	61,462
130,148	175,176	206,286	317,715	447,447	613,144	1404,685
350,431	33,000	47,706	28,450	18,564	18,564	9,443
0.443	0.443	0.443	0.443	0.443	52,848	0.443
87,500	87,500	35,000	4500.000	4425.000	4500.000	15.000
.163	1,633	3,715	7,143	13,433	31,053	29,880
44,547	55,356	87,476	130,130	183,183	300,300	853,333
1213,213						
417,274	0.437	85,384	28,441	18,574	28,461	37,948
0.487	33,548	0.487	0.487	0.487	0.487	54,923
0.487						
87,500	87,500	35,000	4425.000	3450.000	4350.000	22.000
.163	1,633	3,424	6,607	13,143	30,036	29,982
33,454	41,313	51,772	66,673	77,679	84,363	91,330
178,547	135,135	178,333	243,378	420,288	613,000	1383,723
2334,447						
748,447	47,356	37,617	0.479	47,356	18,558	0.479
47,356	75,333	0.479	18,558	0.479	0.479	0.479
28,439	0.479	28,439	18,558	18,558	54,875	47,356
28,439						
87,500	103,500	100,000	3850.000	3425.000	3350.000	24.000
.183	1,839	3,611	6,778	8,769	11,498	17,320
33,817	31,333	43,515	66,087	74,423	81,336	95,984
134,674	128,434	178,111	235,354	267,146	35,778	446,277
258,933	1485,736	4115,734				
747,654	123,137	132,775	104,184	0.398	37,593	37,963
28,305	56,736	47,391	37,593	28,305	18,596	37,963
37,963	18,564	85,384	47,593	47,391	85,384	18,966
56,780	64,187	75,784				
102,500	107,500	105,000	3425.000	3200.000	3600.000	14.000
.222	1,215	2,443	7,124	9,811	11,773	15,706
38,447	35,248	54,356	77,550	102,192	471,471	646,511
245,204	0.460	0.460	0.460	0.460	2,432	0.460
0.460	0.460	0.460	0.460	0.460	0.460	0.460
102,500	112,500	110,000	3200.000	2725.000	2900.000	7.000
.008	1,163	4,802	33,756	37,438	54,856	200,201
123,117	0.469	18,967	0.469	0.469	0.469	0.469
112,500	112,500	115,000	2725.000	2550.000	2550.000	7.000
.131	1,342	11,279	20,580	78,880	241,240	711,144
35,165	0.464	18,578	0.464	0.464	0.464	18,958
112,500	122,500	120,000	2550.000	2650.000	2550.000	7.000
.234	2,693	5,877	9,610	11,201	26,647	327,327
54,637	0.439	0.439	0.439	0.439	0.439	0.439
122,500	127,500	125,000	2650.000	2750.000	2750.000	7.000
.187	1,494	4,676	8,724	8,069	90,494	210,210
161,648	16,549	0.468	0.468	0.468	0.468	0.468
127,500	132,500	130,000	2750.000	2425.000	2750.000	13.000
.212	1,439	2,703	5,647	10,800	17,240	31,432
36,274	97,419	132,132	158,158	208,207	424,424	
680,766	66,519	0.420	28,358	28,358	0.420	0.420
0.420	0.420	0.420	0.420	0.420	0.420	
132,500	137,500	135,000	2425.000	2325.000	2900.000	0.000
.217	1,741	10,480	16,416	28,721	29,514	175,412
204,207	604,211					
811,425	54,773	0.113	0.113	0.113	0.113	18,726
0.113	0.113					
137,500	142,500	140,000	2425.000	2425.000	2350.000	10.000
.277	1,938	2,743	7,443	18,240	25,154	34,774
80,741	95,169	103,103				
643,737	75,431	75,431	7,884	7,884	17,344	7,884
7,884	7,884	7,884				
143,500	147,500	145,000	2675.000	2525.000	2550.000	4.000
.628	1,000	2,543	40,813			

147.500	152.500	150.000	2525.000	2550.000	2550.000	5.000
.199	1.924	3.673	7.476	19.288		
145.974	21.496	14.220	5.404	5.404		
153.500	157.500	155.000	2550.000	2600.000	2550.000	8.000
.243	1.435	3.193	6.706	12.278	32.859	136.135
481.480						
211.575	26.164	26.164	4.351	8.731	4.351	4.351
4.361						
157.500	162.500	160.000	2600.000	2675.000	2650.000	12.000
.243	1.707	3.443	6.896	8.521	12.859	17.217
41.799	92.712	121.120	259.252	345.345		
209.494	16.545	29.661	20.548	6.756	3.362	13.512
6.756	3.362	3.362	3.362	3.362		
162.500	167.500	165.000	2675.000	2600.000	2700.000	16.000
.244	1.732	2.862	6.522	9.396	12.648	17.958
23.414	31.649	42.199	56.476	85.167	74.138	88.532
116.942	145.158					
144.675	16.585	68.978	12.237	4.889	14.497	19.585
4.889	4.889	4.889	2.460	7.348	4.889	2.460
4.889	2.460					
167.500	172.500	170.000	2600.000	2575.000	2500.000	23.000
.295	1.595	3.476	6.447	8.207	12.773	16.867
23.468	31.110	47.927	50.111	64.817	77.171	85.798
97.919	107.447	175.912	235.382	388.381	493.492	529.529
1661.661	2124.123					
107.916	16.727	13.684	16.727	4.554	4.687	7.597
3.043	6.087	3.043	1.511	3.043	3.043	3.043
1.511	4.554	3.043	3.043	1.511	1.511	1.511
1.511	1.511					
172.500	177.500	175.000	2575.000	3116.667	2650.000	24.000
.310	1.447	3.428	6.187	9.107	12.230	17.642
21.640	29.693	39.826	54.297	63.013	73.357	88.006
92.949	112.588	139.714	174.733	230.356	270.361	330.334
483.798	619.146	1549.471				
111.672	23.792	29.611	17.484	6.708	8.707	8.766
6.819	10.187	6.798	2.420	2.889	1.468	.979
2.420	3.399	4.867	5.819	2.420	.979	2.420
.979	2.909	3.776				
177.500	180.000	178.750	3116.667	3350.000	3350.000	21.000
.238	1.496	3.413	6.757	8.247	11.980	17.923
20.934	29.912	43.673	59.961	61.969	72.737	110.445
129.436	175.196	241.731	414.414	888.223	1515.500	2669.187
17.400	1.672	3.347	1.002	.333	1.339	1.002
.669	1.339	2.008	.333	.669	1.002	.669
.669	.333	.333	.333	1.339	2.008	1.339

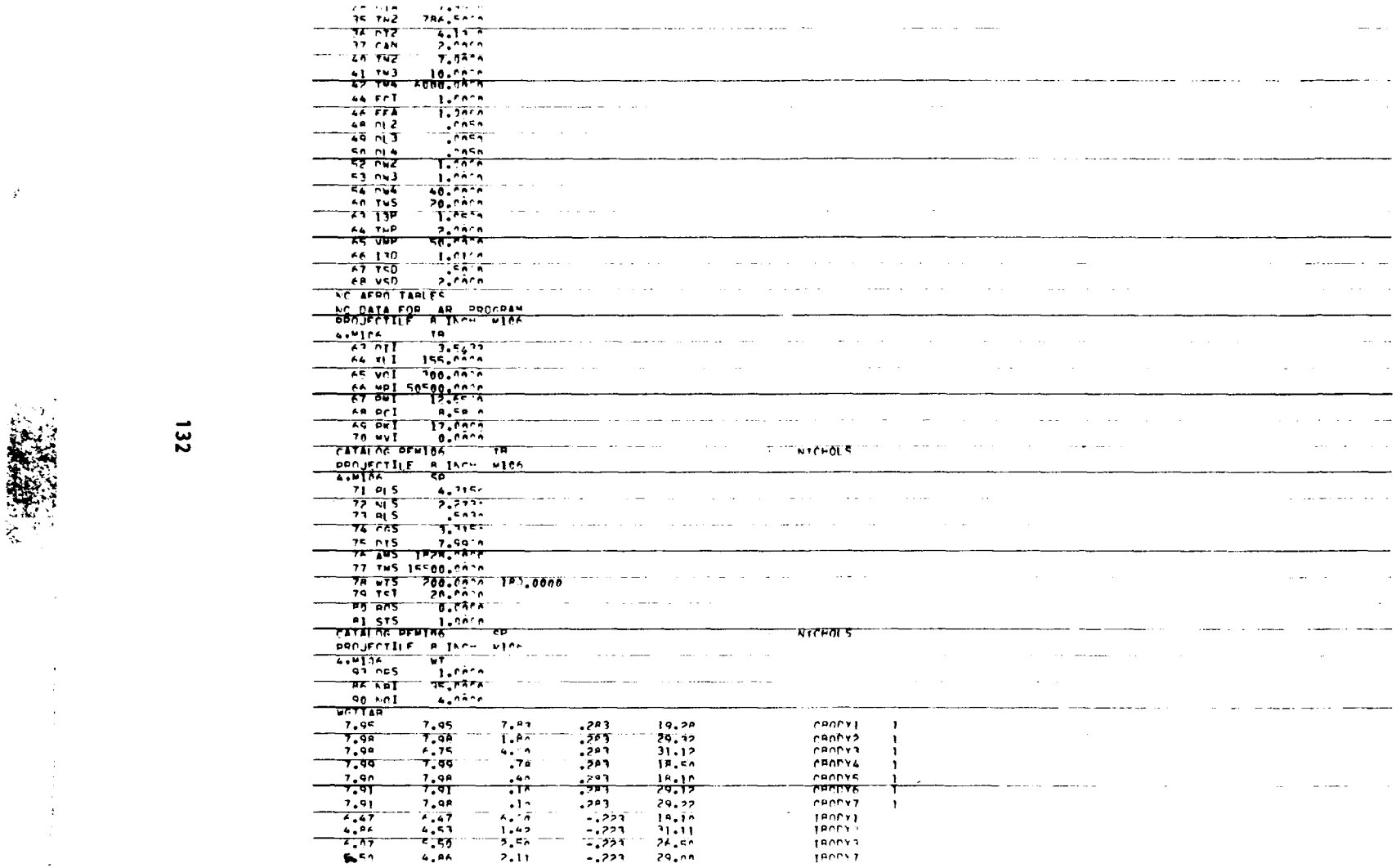
FNMFVM

FCXTAB

0.0	670.0	893.0	1116.0	1339.0	1562.0	1784.0
2232.0	3348.0	5580.0	10044.0			
0.53	0.54	0.58	0.63	0.68	0.70	0.70
0.68	0.64	0.60	0.56			

FNMFMX

PROJECTILE	B INCH	WICK
4 MM4	1.0000	
5 MPC	1.0000	
6 MTM	2.0000	
7 MTM	1.0000	
8 MXX	2.0000	
9 MTM	2.0000	
11 MJR	1.0000	
14 TSP	5.0000	
25 THD	20.0000	
26 VMX	2700.0000	
27 WGT	200.0000	



132

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
6.07	6.07	1.20	-.223	24.10		FRDRY5
6.00	6.00	6.12	0.0	35.00		FRDRY6
1.6	1.6	.10	0.0	3.75		FRDRY8
3.2	3.2	.10	0.0	3.85		FRDRYF
3.0	1.6	.10	0.0	3.85		FRDRYD
1.6	3.2	.1	0.0	4.45		FRDRYF
1.6	3.2	.1	0.0	4.35		FRDRYG
3.2	1.6	.1	0.0	4.35		FRDRYH
1.6	3.2	.1	0.0	4.45		FRDRYI
3.2	1.6	.1	0.0	4.55		FRDRYJ
1.6	3.2	.1	0.0	4.45		FRDRYK
3.2	1.6	.1	0.0	4.75		FRDRYL
1.6	1.6	1.15	.04	4.85		FRDRYM
8.05	8.14	1.	.283	27.12		GRRGTA 1
8.05	8.08	.20	.283	28.12		GRRGTB 1
8.14	8.14	.15	.283	28.32		GRRGTC 1
8.14	8.28	.20	.283	28.47		GRRGTD 1
8.28	8.28	.19	.283	28.47		GRRGTE 1
7.91	7.91	.15	.283	28.77		GRRGTF 1
8.12	8.12	.08	.283	28.02		GRRGTG 1
8.12	7.98	.12	.283	29.00		GRRGTH 1
7.53	7.53	2.00		27.12		IRRGTA
-18.00	60.	14.35	.283	3.75	64.1	DDGIVE 1
-17.90	60.	13.25	-.223	4.65	63.4	IDGIVE
-18.50	60.	3.75	.1	0.0	63.0	FDGIVE 1
	-1.25	1.0	-.223	32.52	1.0	IDRIVE

FRDWGT

CATALOG PERMIAN [illegible] NICHOLS

PROJECTILE A [illegible]

4.M105	LA
113 XRA	3.0000
114 SKP	1.0000
115 XRL	3.0000
117 XY7	3.0000
118 BLR	20.0000
119 ADF	47.0000
120 TVM	1000.0000
123 XRZ	37.0000
125 CCR	1.0000
126 CKO	.5000
129 XRD	11.0000
132 CRP	2.0000
159 XCC	12.0000

FVMTBB

0.000	2.500	1.250	2150.000	2366.667	2150.000	1.000
1.000						
0.000						
2.500	7.500	5.000	2366.667	2575.000	2800.000	1.000
1.000						
0.000						
7.500	12.500	10.000	2575.000	2325.000	2350.000	1.000
1.000						
0.000						
12.500	17.500	15.000	2325.000	2850.000	2300.000	1.000
1.000						
0.000						
17.500	22.500	20.000	2850.000	3100.000	3400.000	1.000
1.000						
0.000						
22.500	27.500	25.000	3100.000	2500.000	2800.000	1.000
1.000						
0.000						
27.500	32.500	30.000	2500.000	3100.000	2800.000	1.000
1.000						

33,500	35,000	3100,000	3275,000	3200,000	1,000	
.174						
33,709						
37,500	40,000	3275,000	3450,000	3350,000	2,000	
.099						
37,599						
42,500	45,000	3450,000	3550,000	3550,000	3,000	
.144						
42,644						
47,500	50,000	3550,000	4200,000	3550,000	4,000	
.225	3,726	39,240				
19,043	9,617	9,617				
52,500	55,000	4200,000	4200,000	4850,000	4,000	
.313	2,953	50,491				
55,932	9,407	9,407				
57,500	60,000	4200,000	3275,000	3550,000	7,000	
.139	2,398	7,456	9,079	43,779	973,973	
141,195	9,466	18,883	9,466	18,883	18,883	9,466
62,500	67,500	65,000	3275,000	3350,000	3200,000	11,000
.217	3,732	7,297	10,961	16,163	26,568	
65,897	93,441	100,000	210,210			
113,791	9,466	18,883	9,466	9,466	28,448	9,466
18,883	9,466	9,466	9,466			
67,500	72,500	70,000	3350,000	3425,000	3500,000	17,000
.127	1,494	2,951	17,933	19,480	29,009	40,267
93,934	93,772	100,445	141,429	171,171	234,882	259,258
398,389	487,494	539,541				
179,971	18,948	9,474	9,474	9,474	9,474	28,423
9,474	9,474	18,948	18,948	9,474	18,948	9,474
9,474	9,474	9,474				
72,500	77,500	75,000	3425,000	3275,000	3750,000	13,000
.087	1,518	2,858	5,505	9,941	12,612	20,713
43,743	101,102	172,171	232,000	438,438	571,000	
188,098	37,865	37,865	9,463	9,463	9,463	37,865
9,463	9,463	9,463	28,429	9,463	28,429	
77,500	82,500	80,000	3425,000	4200,000	3800,000	15,000
.224	1,540	3,154	7,299	8,771	11,000	16,225
21,342	39,705	43,042	57,778	78,261	119,447	179,000
435,282	820,000	1117,674	2424,424			
244,389	37,886	47,358	9,471	18,943	28,415	9,471
9,471	37,886	9,471	9,471	18,943	28,415	28,415
18,943	28,415	47,358	9,471			
82,500	87,500	85,000	4200,000	4500,000	4500,000	14,000
.102	1,403	3,091	6,163	12,778	31,225	61,462
108,188	175,174	284,285	317,918	447,447	618,166	1404,405
168,531	37,892	47,366	28,459	18,946	18,946	9,442
9,463	9,463	9,463	9,463	9,463	56,839	9,463
87,500	92,500	90,000	4500,000	4425,000	4500,000	15,000
.153	1,433	3,218	7,163	12,433	17,453	29,880
46,547	55,209	87,438	120,120	183,183	300,300	853,333
1213,213						
417,276	9,487	85,384	28,461	18,974	28,461	37,948
9,487	37,948	9,487	9,487	9,487	9,487	56,922
9,487						
92,500	97,500	95,000	4425,000	3850,000	4350,000	22,000
.163	1,542	3,424	6,447	13,143	13,936	20,582
30,856	41,912	51,372	65,672	77,679	84,363	91,330
148,647	175,139	194,999	243,378	420,280	438,000	1383,333
2206,447						
466,687	47,366	37,617	9,478	47,366	18,958	9,479
47,394	75,833	9,479	18,958	9,479	9,479	9,479
28,438	9,479	28,438	18,958	18,958	56,875	47,396
28,438						
97,500	102,500	100,000	3550,000	3425,000	3350,000	24,000
.182	1,636	3,611	6,776	8,743	11,000	17,320

22,917	[illegible]	41,515	88,867	78,423	67,130	93,704	
144,274	178,434	178,111	225,454	247,144	350,778	446,277	
768,833	1485,784	4115,734					
747,654	127,177	132,775	104,180	9,788	37,693	37,953	
58,385	58,788	47,781	37,693	58,385	18,894	37,953	
37,993	18,894	85,384	37,693	47,781	85,384	18,956	
58,788	58,787	75,784					
107,500	107,500	105,000	3425,000	3200,000	3500,000	14,000	
.252	1,578	3,443	7,124	9,811	11,737	15,706	
28,447	39,460	54,356	77,650	102,102	471,471	509,511	
228,294	9,460	9,460	9,460	9,460	21,432	9,460	
9,460	9,460	9,460	9,460	9,460	9,460	9,460	
107,500	117,500	110,000	2700,000	2725,000	2900,000	7,000	
.098	1,142	4,882	33,354	37,478	54,856	200,201	
121,117	9,469	18,957	9,469	9,469	9,469	9,469	
112,500	117,500	115,000	2725,000	2550,000	2550,000	7,000	
.131	1,342	11,376	20,680	28,888	241,249	711,144	
95,152	9,456	18,928	9,456	9,456	9,456	18,928	
117,500	122,500	120,000	2550,000	2550,000	2550,000	7,000	
.236	2,462	5,877	9,430	11,201	25,607	327,327	
56,637	9,430	9,430	9,430	9,430	9,430	9,430	
122,500	127,500	125,000	2650,000	2750,000	2750,000	7,000	
.187	1,504	4,674	5,724	8,869	93,694	210,210	
151,868	18,942	9,459	9,459	9,459	9,459	9,459	
127,500	132,500	130,000	2750,000	2825,000	2750,000	13,000	
.212	1,439	2,783	5,667	10,890	10,240	31,432	
35,276	97,619	133,132	158,159	298,297	426,424		
680,759	66,210	9,420	28,259	28,260	9,420	9,420	
9,420	9,420	9,420	9,420	9,420	9,420		
132,500	137,500	135,000	2825,000	2825,000	2900,000	9,000	
.217	1,361	10,480	14,414	28,951	25,614	175,412	
294,297	509,511						
811,825	54,773	9,113	9,113	9,113	9,113	18,226	
9,113	9,113						
137,500	142,500	140,000	2825,000	2825,000	2750,000	10,000	
.277	1,438	2,741	7,437	10,240	22,954	34,574	
80,861	99,428	182,102					
543,737	39,421	39,421	7,884	7,884	15,768	7,884	
7,884	7,884	7,884					
142,500	147,500	145,000	2825,000	2525,000	2500,000	4,000	
.208	1,488	2,647	40,219				
552,130	32,871	15,710	13,161				
147,500	152,500	150,000	2525,000	2550,000	2550,000	5,000	
.133	1,366	2,573	7,479	19,288			
345,974	21,436	16,220	5,406	5,406			
152,500	157,500	155,000	2550,000	2600,000	2550,000	8,000	
.243	1,435	3,193	6,708	12,238	32,853	136,135	
491,490							
219,575	28,164	28,164	4,351	8,791	4,351	4,351	
4,351							
157,500	162,500	160,000	2600,000	2675,000	2650,000	12,000	
.243	1,332	3,443	6,836	8,931	12,853	17,217	
41,700	82,312	131,134	251,352	345,345			
209,496	16,965	23,661	20,268	6,756	3,362	13,512	
6,756	3,362	3,362	3,362	3,362			
162,500	167,500	165,000	2675,000	2600,000	2700,000	14,000	
.244	1,332	2,862	6,522	8,706	12,048	17,958	
33,416	81,449	62,700	56,476	65,167	74,178	88,532	
114,942	149,168						
144,475	15,585	68,978	12,237	4,889	14,697	19,585	
4,889	4,889	4,886	7,468	7,468	4,889	7,468	
4,889	2,468						
147,500	172,500	170,000	2600,000	2575,000	2500,000	23,000	
.206	1,585	3,476	6,447	8,207	12,273	16,867	
34,448	31,110	47,027	50,111	64,817	77,171	85,758	
97,919	107,447	175,912	235,383	380,781	492,493	529,529	

[illegible]	[illegible]					
107.916	14.727	17.684	14.727	4.554	4.087	7.567
3.043	4.087	3.043	1.511	3.043	3.043	3.043
1.511	4.554	3.043	3.043	1.511	1.511	1.511
1.511	1.511					
172.500	172.500	175.000	2575.000	3116.667	2650.000	24.000
.314	1.447	3.428	4.187	8.107	12.230	17.447
21.688	29.477	39.826	54.397	43.413	71.357	88.006
93.989	113.508	138.716	174.331	230.364	278.361	330.334
403.798	415.146	1539.471				
111.672	23.792	29.611	17.684	4.788	8.787	8.266
5.819	12.187	4.788	2.428	2.509	1.468	.979
2.428	2.509	4.847	5.819	2.428	.979	2.428
.979	2.509	7.776				
177.500	180.000	178.750	3116.667	3358.000	3350.000	21.000
.294	1.434	3.413	4.757	8.267	11.580	17.923
20.934	29.912	43.673	59.961	41.969	72.733	110.445
128.436	175.176	231.231	414.414	800.223	1515.600	2669.167
17.488	1.479	1.947	1.002	.333	1.333	1.002
.669	1.339	2.008	.333	.669	1.002	.669
.669	.333	.333	.333	1.339	2.008	1.339

FADFVM
FORTAB

0.0	470.0	893.0	1114.0	1339.0	1562.0	1786.0
2232.0	2348.0	5580.0	10044.0			
0.53	0.54	0.56	0.62	0.68	0.70	0.70
0.68	0.64	0.61	0.56			

FADFDX
CATALOG REMOS 1A
PROJECTILE A INCH M106 NICHOLS
4.M106 YD
NO AD BALLISTIC COEFFICIENT TABLES
NO DATA FOR YD PROGRAM
PROJECTILE A INCH M106
4.M106 BM
RECOIL TABLES - THD AND PRG-NO INCLUDED
NO DATA FOR BM PROGRAM
PROJECTILE A INCH M106
4.M106 SD
NO DATA FOR SD PROGRAM
PROJECTILE A INCH M106
4.M106 TM
NO DATA FOR TM PROGRAM

APPENDIX K

SAMPLE TTY & BATCH RESULTS

Section K-1

PROJECTILE 8 INCH M106

WEIGHT CALCULATION REQUESTED
PLOT REQUESTED
STABILITY CALCULATION NOT REQUESTED

34 BODY ITEMS
0 FINS
0 FIN PIECES
0 KNOWN ITEMS
4 OGIVES
1 COPIES OUTPUT REQUESTED
0 DATA CHANGES

PROJECTILE A INCH M106

INPUT DATA FOR BODY OF SHELL

NO.	IDENTIFICATION		D1	D2	LENGTH	DENSITY	REFERENCE
1	OBODY1	1	7.9800	7.9800	7.8300	.2830	19.2800
2	OBODY2	1	7.9800	7.9800	1.8000	.2830	29.3200
3	OBODY3	1	7.9800	6.7500	4.0000	.2830	31.1200
4	OBODY4	1	7.9900	7.9900	.7800	.2830	18.5000
5	OBODY5	1	7.9000	7.9800	.4000	.2830	18.1000
6	OBODY6	1	7.9100	7.9100	.1000	.2830	29.1200
7	OBODY7	1	7.9100	7.9800	.1000	.2830	29.7200
8	IBODY1	A	6.4700	6.4700	6.0000	-.2230	18.1000
9	IBODY2	A	4.8600	4.5300	1.4200	-.2230	31.1100
10	IBODY3	A	6.0700	5.5000	2.5000	-.2230	26.5000
11	IBODY7	A	5.5000	4.8600	2.1100	-.2230	29.0000
12	IBODY4	A	6.3000	6.0700	1.2000	-.2230	25.3000
13	IBODY5	A	6.4700	6.4000	1.2000	-.2230	24.1000
14	IBODY6	A	6.0000	6.0000	.1200	0.0000	35.0000
15	FBODYA	A	1.6000	1.6000	.1000	0.0000	3.7500
16	FBODYC	A	1.6000	2.0000	.1000	0.0000	3.8500
17	FBODYD	A	2.0000	1.6000	.1000	0.0000	3.9500
18	FBODYE	A	1.6000	2.0000	.1000	0.0000	4.0500
19	FBODYF	A	2.0000	1.6000	.1000	0.0000	4.1500
20	FBODYG	A	1.6000	2.0000	.1000	0.0000	4.2500
21	FBODYH	A	2.0000	1.6000	.1000	0.0000	4.3500
22	FBODYI	A	1.6000	2.0000	.1000	0.0000	4.4500
23	FBODYJ	A	2.0000	1.6000	.1000	0.0000	4.5500
24	FBODYK	A	1.6000	2.0000	.1000	0.0000	4.6500
25	FBODYL	A	2.0000	1.6000	.1000	0.0000	4.7500
26	FBODYM	A	1.6000	1.6000	1.1500	.0400	4.8500
27	OBROTA	1	8.0500	8.1400	1.0000	.2830	27.1200
28	OBROTB	1	8.0500	8.0800	.2000	.2830	28.1200
29	OBROTC	1	8.1400	8.1400	.1500	.2830	28.3200
30	OBROTD	1	8.1400	8.2800	.2000	.2830	28.4700
31	OBROTE	1	8.2800	8.2800	.1000	.2830	28.6700
32	OBROTF	1	7.9100	7.9100	.1500	.2830	28.7700
33	OBROTG	1	8.1200	8.1200	.0800	.2830	28.9200
34	OBROTH	1	8.1200	7.9800	.1200	.2830	29.0000
35	IBROTA	A	7.5300	7.5700	2.0000	-0.0000	27.1200

INPUT DATA FOR OGIVAL ITEMS

NO.	IDENTIFICATION		A	B	LENGTH	DENSITY	REFERENCE	RADIUS
1	OOGIVE	1	-18.9000	60.0000	14.3500	.2830	3.7500	64.1000
2	IOGIVF	A	-17.9000	60.0000	13.2500	-.2230	4.8500	61.4000
3	FOGIVE	1	-18.5000	60.0000	3.7500	.1000	0.0000	61.0000
4	IOGIVE	A	-6.0000	-1.2600	1.0000	-.2230	32.5200	1.0000

PROJECTILE 8 INCH M106

PROPERTIES OF BODY ITEMS

NO.	IDENTIFICATION		WEIGHT	POLAR I	TRANSVERSE I	CG TO REF	VOLUME
1	OBODY1	1	189.9449	868.8998	561.9720	23.1956	388.6744
2	OBODY2	1	25.4774	202.8012	6.8789	30.2200	90.0261
3	OBODY3	1	48.3382	331.5554	63.9746	33.0089	170.8062
4	OBODY4	1	11.0679	88.1218	.5611	18.8900	39.1091
5	OBODY5	1	5.6051	44.1723	.0747	18.3087	19.8059
6	OBODY6	1	1.3907	10.8766	.0012	29.1700	4.9141
7	OBODY7	1	1.4038	11.0708	.0012	29.2701	4.9577
8	IBODY1	0	-43.9901	-238.1830	-131.9702	21.1000	197.2649
9	IBODY2	0	-5.4845	-15.1428	-.9204	31.8034	24.5939
10	IBODY3	0	-14.6654	-61.5973	-7.6185	27.7090	65.7639
11	IBODY7	0	-9.9286	-33.5127	-3.6686	30.0116	44.5230
12	IBODY4	0	-8.8409	-38.4720	-.9646	25.8926	36.0579
13	IBODY5	0	-8.5689	-43.4801	-1.0241	24.6447	38.4254
14	IBODY6	0	0.0000	0.0000	0.0000	35.0600	3.3929
15	FBODYB	0	0.0000	0.0000	0.0000	3.8000	.2011
16	FBODYC	0	0.0000	0.0000	0.0000	3.9037	.2555
17	FBODYD	0	0.0000	0.0000	0.0000	3.9963	.2555
18	FBODYE	0	0.0000	0.0000	0.0000	4.1037	.2555
19	FBODYF	0	0.0000	0.0000	0.0000	4.1963	.2555
20	FBODYG	0	0.0000	0.0000	0.0000	4.3037	.2555
21	FBODYH	0	0.0000	0.0000	0.0000	4.3963	.2555
22	FBODYI	0	0.0000	0.0000	0.0000	4.5037	.2555
23	FBODYJ	0	0.0000	0.0000	0.0000	4.5963	.2555
24	FBODYK	0	0.0000	0.0000	0.0000	4.7037	.2555
25	FBODYL	0	0.0000	0.0000	0.0000	4.7963	.2555
26	FBODYM	0	.0925	.0296	.0102	5.4250	2.3122
27	OBROTA	1	14.5651	119.7110	1.2137	27.6219	51.4669
28	OBROTB	1	2.8914	23.5091	.0096	28.2201	10.2171
29	OBROTC	1	2.2091	18.2968	.0041	28.3956	7.8060
30	OBROTD	1	2.9964	25.2495	.0100	28.5706	10.5881
31	OBROTE	1	1.5238	13.0589	.0013	28.7200	5.3846
32	OBROTF	1	2.0860	16.9149	.0039	28.8450	7.3711
33	OBROTG	1	1.1724	9.6627	.0006	28.9600	4.1428
34	OBROTH	1	1.7285	14.0029	.0021	29.0597	6.1076
35	IBROTA	0	0.0000	0.0000	0.0000	28.1200	89.0656

PROPERTIES OF OGIVAL ITEMS

NO.	IDENTIFICATION		WEIGHT	POLAR I	TRANSVERSE I	CG TO REF	VOLUME
1	OOGIVE	1	113.4678	621.7008	1461.2430	12.9176	400.9467
2	IOGIVE	0	-52.3258	-189.6640	-540.4681	13.5185	234.6448
3	FOGIVE	1	.7777	.1749	.5799	2.6020	7.7767
4	ICURVE	0	-2.4653	-6.5343	-.2234	32.9644	13.2974

PROJECTILE A INCH M106

PROPERTIES OF ENTIRE SHELL

WEIGHT= 200.8185 POUNDS

CG TO REF= 22.7413 INCHES

POLAR INERTIA= 1800.5168 POUND INCH SQUARE

TRANSVERSE INERTIA= 15062.7227 POUND INCH SQUARE

OUTER VOLUME= 1230.1008 CUBIC INCHES

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00
PROJECTILE  8 INCH  M106
 35    0    0    0    4    0          000 00
     7.9500     7.9500     7.8700      .2830    19.2800                 OBODY1    1
     7.9800     7.9800     1.0000      .2830    29.3200                 OBODY2    1
     7.9800     6.9500     4.0000      .2830    31.1200                 OBODY3    1
     7.9900     7.9900      .7800      .2830    18.5000                 OBODY4    1
     7.9000     7.9800      .4000      .2830    18.1000                 OBODY5    1
     7.9100     7.9100      .1000      .2830    29.1200                 OBODY6    1
     7.9100     7.9800      .1000      .2830    29.2200                 OBODY7    1
     6.4700     6.4700     6.0000     -.2230    18.1000                 IBODY1    0
     4.8600     4.8700     1.4200     -.2230    31.1100                 IBODY2    0
     6.0700     5.5000     2.5000     -.2230    26.5000                 IBODY3    0
     5.5000     4.8600     2.1100     -.2230    29.0000                 IBODY7    0
     6.3000     6.0700     1.2000     -.2230    25.3000                 IBODY4    0
     6.4700     6.3000     1.2000     -.2230    24.1000                 IBODY5    0
     6.8000     6.8000      .1200     0.0000    35.0000                 IBODY6    0
     1.6000     1.4000      .1000     0.0000     1.7500                 FBODYB    0
     1.6000     2.0000      .1000     0.0000     1.8500                 FBODYC    0
     2.0000     1.6000      .1000     0.0000     1.9500                 FBODYD    0
     1.6000     2.0000      .1000     0.0000     4.0500                 FBODYE    0
     2.0000     1.4000      .1000     0.0000     4.1500                 FBODYF    0
     1.6000     2.0000      .1000     0.0000     4.2500                 FBODYG    0
     2.0000     1.4000      .1000     0.0000     4.3500                 FBODYH    0
     1.6000     2.0000      .1000     0.0000     4.4500                 FBODYI    0
     2.0000     1.4000      .1000     0.0000     4.5500                 FBODYJ    0
     1.6000     2.0000      .1000     0.0000     4.6500                 FBODYK    0
     2.0000     1.4000      .1000     0.0000     4.7500                 FBODYL    0
     1.6000     1.6000     1.1500      .0400     4.8500                 FBODYM    0
     8.0500     8.1400     1.0000      .2830    27.1200                 OBROTA    1
     8.0500     8.0800      .2000      .2830    28.1200                 OBROTB    1
     8.1400     8.1400      .1500      .2830    28.3200                 OBROTC    1
     8.1400     8.2800      .2000      .2830    28.4700                 OBROTD    1
     8.2800     8.2800      .1000      .2830    28.6700                 OBROTE    1
     7.9100     7.9100      .1500      .2830    28.7700                 OBROTF    1
     8.1200     8.1200      .0800      .2830    28.9200                 OBROTG    1
     8.1200     7.9800      .1200      .2830    29.0000                 OBROTH    1
     7.5300     7.5300     2.0000    -0.0000    27.1200                 IBROTA    0
   -25.9000    60.0000    14.3500      .2830     3.7500    64.1000 OOGIVE    1
   -17.9000    60.0000    13.2500     -.2230     4.8500    63.4000 IOGIVE    0
   -14.5000    60.0000     3.7500      .1000     0.0000    63.0000 FOGIVE    1
    -0.0000    -1.2600     1.0000     -.2230    32.5200     1.0000 ICURVE    0
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Section K-2

PROJECTILE A INCH MIRA

INPUT DATA FOR BODY OF SHELL

NO.	IDENTIFICATION		D1	D2	LENGTH	DENSITY	REFERENCE
1	ABODY1	1	7.9000	7.9000	7.8100	.2830	14.2000
2	ABODY2	1	7.9000	7.9000	1.8000	.2830	29.3200
3	ABODY3	1	7.9000	6.7500	4.0000	.2830	31.1200
4	ABODY4	1	7.9000	7.9000	.7800	.2830	18.5000
5	ABODY5	1	7.9000	7.9000	.4000	.2830	18.1000
6	ABODY6	1	7.9100	7.9100	.1000	.2830	29.1200
7	ABODY7	1	7.9100	7.9000	.1000	.2830	29.2200
8	IBODY1	0	6.4700	6.4700	6.0000	-.2270	18.1000
9	IBODY2	0	6.8600	6.5300	1.4200	-.2270	31.1100
10	IBODY3	0	6.0700	5.5000	2.5000	-.2270	26.5000
11	IBODY4	0	5.5000	6.8600	3.1100	-.2270	29.8000
12	IBODY5	0	6.3000	6.0700	1.2000	-.2270	25.3000
13	IBODY6	0	6.6700	6.3000	1.2000	-.2270	24.1000
14	IBODY7	0	6.0000	6.0000	.1200	0.0000	35.0000
15	FBODY8	0	1.6000	1.6000	.1000	0.0000	3.2500
16	FBODY9	0	1.6000	2.0000	.1000	0.0000	3.9500
17	FBODYA	0	2.0000	1.6000	.1000	0.0000	3.9500
18	FBODYB	0	1.6000	2.0000	.1000	0.0000	4.0500
19	FBODYC	0	2.0000	1.6000	.1000	0.0000	4.1500
20	FBODYD	0	1.6000	2.0000	.1000	0.0000	4.2500
21	FBODYE	0	2.0000	1.6000	.1000	0.0000	4.3500
22	FBODYF	0	1.6000	2.0000	.1000	0.0000	4.4500
23	FBODYG	0	2.0000	1.6000	.1000	0.0000	4.5500
24	FBODYH	0	1.6000	2.0000	.1000	0.0000	4.6500
25	FBODYI	0	2.0000	1.6000	.1000	0.0000	4.7500
26	FBODYJ	0	1.6000	1.6000	1.1500	.0400	4.8500
27	OBODY8	1	8.0500	8.1400	1.0000	.2830	27.1200
28	OBODY9	1	8.0500	8.0800	.2000	.2830	28.1200
29	OBODYA	1	8.1400	8.1400	.1500	.2830	28.1200
30	OBODYB	1	8.1400	8.2800	.2000	.2830	28.4700
31	OBODYC	1	8.2800	8.2800	.1000	.2830	28.4700
32	OBODYD	1	7.9100	7.9100	.1500	.2830	28.7700
33	OBODYE	1	8.1300	8.1300	.0000	.2830	28.9200
34	OBODYF	1	8.1200	7.9000	.1200	.2830	29.0000
35	IBODY8	0	7.5300	7.5300	3.0000	-0.0000	27.1200

INPUT DATA FOR OGIVAL ITEMS

NO.	IDENTIFICATION		A	B	LENGTH	DENSITY	REFERENCE	RADIUS
1	OGIVE	1	-19.9000	60.0000	14.3500	.2830	3.7500	64.1000
2	IOGIVE	0	-17.5000	60.0000	13.2500	-.2270	4.8500	63.4000
3	FOGIVE	1	-19.5000	60.0000	3.7500	.1000	0.0000	63.0000

PROJECTILE 8 INCH M106

PROPERTIES OF BODY ITEMS

NO.	IDENTIFICATION		WEIGHT	POLAR I	TRANSVERSE I	CG TO REF	VOLUME
1	BBODY1	1	190.0620	8XX.6548	541.9728	24.1958	188.8746
2	BBODY2	1	25.4774	202.8812	4.8789	30.2200	90.0241
3	BBODY3	1	51.2410	351.4722	47.8130	33.0085	170.8042
4	BBODY4	1	11.0479	88.2218	.5611	18.8900	39.1491
5	BBODY5	1	5.6081	44.1729	.0747	18.7007	19.8859
6	BBODY6	1	1.3507	10.8766	.0012	29.1700	4.9141
7	BBODY7	1	1.4638	11.6128	.0012	29.2701	4.9577
8	TBODY1	A	-43.9501	-230.1838	-131.9702	21.1000	197.2449
9	TBODY2	A	-5.4845	-15.1438	-.9204	31.8036	24.5936
10	TBODY3	A	-14.4454	-41.5073	-7.6185	27.7000	65.7639
11	TBODY7	A	-9.9386	-33.5127	-3.6686	30.0116	44.5734
12	TBODY4	A	-8.0409	-38.4720	-.9646	25.8026	36.0579
13	TBODY5	A	-8.5486	-41.2001	-1.0241	24.4947	38.4254
14	TBODY6	A	0.0000	0.0000	0.0000	35.0400	3.3926
15	FBODYB	A	0.0000	0.0000	0.0000	3.9000	.2811
16	FBODYC	A	0.0000	0.0000	0.0000	3.9037	.2555
17	FBODYD	A	0.0000	0.0000	0.0000	3.9043	.2555
18	FBODYE	A	0.0000	0.0000	0.0000	4.1037	.2555
19	FBODYF	A	0.0000	0.0000	0.0000	4.1043	.2555
20	FBODYG	A	0.0000	0.0000	0.0000	4.3037	.2555
21	FBODYH	A	0.0000	0.0000	0.0000	4.3043	.2555
22	FBODYI	A	0.0000	0.0000	0.0000	4.5037	.2555
23	FBODYJ	A	0.0000	0.0000	0.0000	4.5043	.2555
24	FBODYK	A	0.0000	0.0000	0.0000	4.7037	.2555
25	FBODYL	A	0.0000	0.0000	0.0000	4.7043	.2555
26	FBODYM	A	.0025	.0256	.0102	5.4250	2.9122
27	BBODY8	1	14.5651	119.2110	1.2137	27.6210	51.4669
28	BBODY9	1	2.8814	23.5691	.0096	28.2201	10.2171
29	BBODYC	1	2.2791	18.3648	.0041	28.1954	7.8888
30	BBODYD	1	2.9966	25.2495	.0100	28.5706	10.6881
31	BBODYE	1	1.6218	14.0588	.0013	28.7200	5.7846
32	BBODYF	1	2.0869	16.3149	.0039	28.8450	7.3711
33	BBODYG	1	1.1724	9.6427	.0006	28.9600	4.1428
34	BBODYH	1	1.7285	14.0029	.0021	29.0597	6.1074
35	TBODY8	A	0.0000	0.0000	0.0000	28.1200	89.0656

PROPERTIES OF NATURAL ITEMS

NO.	IDENTIFICATION		WEIGHT	POLAR I	TRANSVERSE I	CG TO REF	VOLUME
1	POGIVE	1	113.4678	621.7008	1441.2430	12.9174	400.9461
2	TOGIVE	-	-52.3258	-199.4440	-540.4481	13.5186	234.4668
3	EOGIVE	1	.7777	.3749	.5795	2.6020	7.7747

*PROJECTILE 8 INCH M106

PROPERTIES OF ENTIRE SHELL

WEIGHT= 206.6875 POUNDS

CG TO REF= 23.0323 INCHES

POLAR INERTIA= 1824.9678 POUND INCH SQUARE

TRANSVERSE INERTIA= 15678.5757 POUND INCH SQUARE

OUTER VOLUME= 1238.1008 CUBIC INCHES

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PROJECTILE A [illegible] 000 00

75 0 0	0	0					
7.0500	7.0500	7.0400	.2830	10.2800		PROPX1	1
7.0800	7.0800	1.0000	.2830	20.3200		PROPX2	1
7.0800	6.2500	4.0000	.2830	31.1200		PROPX3	1
7.0900	7.0000	.7000	.2830	10.5000		PROPX4	1
7.0800	7.0800	.4000	.2830	10.1000		PROPX5	1
7.0100	7.0100	.1000	.2830	20.1200		PROPX6	1
7.0100	7.0800	.1000	.2830	30.2200		PROPX7	1
6.4700	6.4700	6.0000	-.2230	10.1000		TROPX1	0
4.4600	4.4500	1.4300	-.2230	31.1100		TROPX2	0
6.0700	5.5000	2.5000	-.2230	28.5000		TROPX3	0
5.5000	4.0400	2.1100	-.2230	20.0000		TROPX4	0
4.3000	4.0700	1.2000	-.2230	25.3000		TROPX5	0
4.4700	4.3000	1.2000	-.2230	24.1000		TROPX6	0
4.0000	4.0000	.1200	0.0000	35.0000		TROPX7	0
1.4000	1.2400	.1000	0.0000	4.7500		PROPXB	0
1.4600	2.0000	.1000	0.0000	3.8500		PROPXC	0
2.0000	1.4000	.1000	0.0000	3.9500		PROPXD	0
1.4000	2.0000	.1000	0.0000	4.0500		PROPXE	0
2.0000	1.4000	.1000	0.0000	4.1500		PROPXF	0
1.4000	2.0000	.1000	0.0000	4.2500		PROPXG	0
2.0000	1.4000	.1000	0.0000	4.3500		PROPXH	0
1.4000	2.0000	.1000	0.0000	4.4500		PROPXI	0
2.0000	1.4000	.1000	0.0000	4.5500		PROPXJ	0
1.4000	2.0000	.1000	0.0000	4.6500		PROPXK	0
2.0000	1.4000	.1000	0.0000	4.7500		PROPXL	0
1.4000	1.4000	1.1500	.0400	4.8500		PROPXM	0
8.0500	8.1400	1.4000	.2830	27.1200		PROPTA	1
8.0500	8.0400	.2000	.2830	28.1200		PROPTB	1
8.1400	8.1400	.1500	.2830	28.3200		PROPTC	1
8.1400	8.2800	.2000	.2830	28.4700		PROPTD	1
8.2800	8.2800	.1000	.2830	28.6700		PROPTE	1
7.9100	7.9100	.1500	.2830	28.7700		PROPTF	1
8.1200	8.1200	.0800	.2830	28.9200		PROPTG	1
8.1200	7.9800	.1200	.2830	29.0000		PROPTH	1
7.5300	7.5300	2.0000	-0.0000	27.1200		TROPTA	0
-10.9000	40.0000	14.3500	.2830	3.7500	64.1000	FOGIVE	1
-17.0000	40.0000	13.2500	-.2230	4.8500	63.4000	TOGIVE	0
-10.5000	40.0000	3.7500	.1000	0.0000	63.0000	FOGIVE	1

Section K-3

AEROBALLISTICS BRANCH
ENGINEERING SCIENCES LABORATORY

AERODYNAMIC COEFFICIENTS

TOTAL LENGTH	NOSE LENGTH	BOATTAIL LENGTH	CG (FM NOSE)	DIAMETER INCHES	AXIAL LB IN SQ	TRANSVERSE LB IN SQ	WEIGHT LBS	TWIST CAL/TURN	BOOM LENGTH
4.315	2.273	.503	3.500	7.990	1828.000	15500.000	200.000	20.000	0.000

MACH	CD_T	CNA	CMA	CPN	CYPA	CNPA	CPF	CNPAS	CPFS	CMQ+CMA	CLP	GYRO	SBAR	RECIP	SBARS	RECIPS
.810	.132	1.636	4.295	.875	.470	-.680	2.053	-.294	2.875	5.301	.014	2.193	2.191	-2.394	.370	1.659
.900	.133	1.636	4.393	.815	.470	-.680	2.053	-.294	2.875	4.762	.014	2.145	2.576	-.673	.435	1.469
.900	.137	1.681	4.728	.688	.587	-.767	2.195	-.324	2.949	3.762	.014	1.993	4.620	-.083	.870	1.017
.900	.171	1.763	5.168	.574	.705	-.770	2.407	-.233	3.170	2.532	.011	1.826	13.180	-.007	.124	4.285
.950	.222	1.901	5.572	.569	.822	-.840	2.478	-.241	3.287	1.070	.010	1.691	-11.523	-.006	-.019	-26.308
1.000	.354	2.000	5.282	.859	.783	-.745	2.549	-.201	3.243	-1.237	.009	1.783	-2.736	-.077	.187	2.951
1.050	.394	2.122	5.186	1.057	.744	-.655	2.620	-.180	3.258	-1.622	.009	1.817	-1.898	-.135	.315	1.886
1.100	.393	2.184	5.106	1.162	.666	-.539	2.690	-.151	3.273	-1.699	.009	1.845	-1.264	-.242	.470	1.390
1.200	.383	2.269	4.990	1.301	.572	-.402	2.797	-.121	3.288	-1.776	.009	1.888	-.562	-.495	.633	1.156
1.350	.361	2.355	4.980	1.385	.517	-.309	2.903	-.102	3.302	-1.852	.009	1.892	-.094	-5.072	.761	1.072
1.500	.346	2.473	4.921	1.510	.454	-.207	3.044	-.076	3.332	-2.004	.009	1.914	.367	1.669	.858	1.021
1.750	.327	2.609	4.870	1.633	.439	-.147	3.165	-.074	3.332	-2.160	.009	1.935	.629	1.159	.885	1.013
2.000	.297	2.726	4.887	1.707	.439	-.147	3.165	-.074	3.332	-2.314	.009	1.928	.656	1.134	.896	1.011
2.500	.262	2.860	4.747	1.840	.439	-.147	3.165	-.074	3.332	-2.468	.008	1.984	.687	1.109	.911	1.008
3.000	.235	2.930	4.674	1.905	.439	-.147	3.165	-.074	3.332	-2.545	.008	2.016	.704	1.096	.921	1.006
4.000	.197	2.981	4.708	1.877	.439	-.147	3.165	-.074	3.332	-2.468	.007	2.001	.716	1.088	.934	1.004
5.000	.178	2.837	4.703	1.842	.439	-.147	3.165	-.074	3.332	-2.391	.007	2.003	.713	1.090	.937	1.004

(PD/V) IS USED FOR ALL SPIN DEPENDENT COEFFICIENTS

AEROBALLISTICS BRANCH
ENGINEERING SCIENCES LABORATORY

STABILITY ANALYSIS

	TOTAL LENGTH	NOSE LENGTH	BOATTAIL LENGTH	CG (FM NOSE)	DIAMETER INCHES	AXIAL LB IN SQ	TRANSVERSE LB IN SQ	WEIGHT LBS	TWIST CAL/TURN	BODY LENGTH
	4.315	2.273	.583	3.580	7.990	1828.000	15500.000	200.000	20.000	0.000

MACH	GYRO	SIGMA	RATE	SPIN	W1	W2	L1	L2	L1*	L2*	DELT
.01	2.193	.738	5.622	5.7	.54	.08	.000047	-.000248	-.000177	-.000005	.2909
.60	2.145	.731	5.423	316.1	32.25	5.02	.000103	-.000255	-.000142	-.000010	.0049
.80	1.993	.706	4.799	421.4	42.39	7.31	.000232	-.000327	-.000059	-.000035	.0037
.90	1.826	.673	4.108	474.1	44.76	9.15	.000331	-.000353	-.000040	.000019	.0034
.95	1.691	.639	3.543	500.4	48.37	10.65	.000500	-.000432	.000065	.000003	.0032
1.00	1.783	.663	3.931	526.8	51.65	10.47	.000574	-.000373	.000192	.000009	.0030
1.05	1.817	.670	4.069	553.1	54.48	10.75	.000530	-.000300	.000201	.000029	.0029
1.10	1.845	.677	4.187	579.4	57.29	11.05	.000451	-.000212	.000184	.000054	.0027
1.20	1.888	.686	4.365	632.1	62.84	11.71	.000358	-.000109	.000167	.000081	.0025
1.35	1.892	.687	4.381	711.1	70.72	13.14	.000298	-.000040	.000158	.000100	.0022
1.50	1.914	.691	4.475	790.1	78.80	14.39	.000237	.000038	.000149	.000125	.0020
1.75	1.935	.695	4.559	921.8	92.14	16.58	.000205	.000087	.000156	.000136	.0017
2.00	1.928	.694	4.530	1053.5	105.22	19.03	.000213	.000095	.000164	.000144	.0015
2.50	1.984	.704	4.764	1316.9	132.35	22.96	.000221	.000105	.000172	.000153	.0012
3.00	2.016	.710	4.893	1580.3	159.33	27.04	.000224	.000110	.000176	.000158	.0010
4.00	2.001	.707	4.832	2107.1	212.13	36.37	.000220	.000108	.000172	.000157	.0007
5.00	2.007	.708	4.841	2633.8	265.21	45.41	.000216	.000104	.000168	.000152	.0006

```
11
1MOD        1MOD
MOD 8 IN PROJECTILE
  4.315  2.273   .503  3.500  7.990  182A. 15500.   200.    20.    0.10000
```

Section K-4

```
000112122  0  103 0 0 0                                    00          0.          0.
WCP # IN PROJECTILE
   .010    .400    .900    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   3.000   2.500   3.000   4.000   5.000   0.000   0.000   0.000
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
   .142    .137    .137    .174    .222    .264    .394    .394    .383    .361
   .346    .322    .297    .262    .235    .197    .178   0.000   0.000   0.000
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
    20.000  2300.000    200.000       7.990       0.000          0.000       0.000
     0.000       0.000       0.000     784.500       4.130          5.000       0.000
     0.000       7.000      10.000    6000.000       0.000          1.000       0.000
     1.000
   0.000     .005     .005     .005    0.000   1.000   1.000  40.000
       0.0         0.0         0.0         0.0         0.0        20.0
000112122  0  103 0 0 0                                    00          0.          0.
WCP # IN PROJECTILE
   .010    .400    .900    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   3.000   2.500   3.000   4.000   5.000   0.000   0.000   0.000
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
   .139    .139    .144    .182    .233    .272    .414    .413    .402    .379
   .363    .338    .312    .275    .247    .207    .187   0.000   0.000   0.000
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
    20.000  2300.000    200.000       7.990       0.000          0.000       0.000
     0.000       0.000       0.000     784.500       4.130          5.000       0.000
     0.000       7.000      10.000    6000.000       0.000          1.000       0.000
     1.000
   0.000     .005     .005     .005    0.000   1.000   1.000  40.000
       0.0         0.0         0.0         0.0         0.0        20.0
000112122  0  103 0 0 0                                    00          0.          0.
WCP # IN PROJECTILE
   .010    .400    .900    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   3.000   2.500   3.000   4.000   5.000   0.000   0.000   0.000
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
   .142    .137    .137    .174    .222    .264    .394    .394    .383    .361
   .346    .322    .297    .262    .235    .197    .178   0.000   0.000   0.000
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
    22.000  2300.000    200.000       7.990       0.000          0.000       0.000
     0.000       0.000       0.000     784.500       4.130          5.000       0.000
     0.000       7.000      10.000    6000.000       0.000          1.000       0.000
     1.000
   0.000     .005     .005     .005    0.000   1.000   1.000  40.000
       0.0         0.0         0.0         0.0         0.0        20.0
000112122  0  103 0 0 0                                    00          0.          0.
WCP # IN PROJECTILE
   .010    .400    .900    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   3.000   2.500   3.000   4.000   5.000   0.000   0.000   0.000
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
   .142    .137    .137    .174    .222    .264    .394    .394    .383    .361
   .346    .322    .297    .262    .235    .197    .178   0.000   0.000   0.000
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
    20.000  2350.000    200.000       7.990       0.000          0.000       0.000
     0.000       0.000       0.000     784.500       4.130          5.000       0.000
     0.000       7.000      10.000    6000.000       0.000          1.000       0.000
     1.000
   0.000     .005     .005     .005    0.000   1.000   1.000  40.000
       0.0         0.0         0.0         0.0         0.0        20.0
```

AEROBALLISTICS BRANCH
TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

MOD 8 IN PROJECTILE

	NEIT	FDCOR	NTHRST	KT	M	NUMTT	JN	NJP	TAUTO	ISPEN	TA	NATMS	ACRM
	MAG	1	2	1	2	5	0	1	0	2	0	0	0

FOUR TABLE ENTRY PHASES TWO AND FOUR

MACH	.810	.600	.800	.900	.950	1.000	1.050	1.100	1.200	1.350
	1.500	1.750	2.000	3.500	4.000	4.000	5.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FA	.133	.112	.117	.173	.222	.354	.384	.397	.387	.361
	.344	.322	.297	.262	.235	.197	.179	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

THREG	V	WRT	DTA	X	Y	Z
90.000	2700.000	200.000	7.990	0.000	0.000	0.000

THRLST	DOTM	RWGT	THR2	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	986.5000	4.130	2.0	0.000

TTW(1)	TTP(2)	TTW(3)	TTW(4)	CKD	FACT	YF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	40.000

SPIN	TK(1)	TK(2)	TK(3)	TK(4)	TWIST	IKTTIBI	TURNS (PREV)
0.000	0.000	0.000	0.000	0.000	20.000		-0.000

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

FREE-FLIGHT OF MAIN STAGE

TIME	RANGE X-DFFCTV SPIN RATE TOTAL TIME	ALTITUDE Y-DFFCTV AERO STAB	VELOCITY V-DFFCTV DYNAMIC	THETA TH-DFFCTV RECIPROCAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MASS THRUST WEIGHT	CD DRAG PRAF/MASS	YAW LEND YAW FREQ SPIN RPS	SLANT DIST TEMPERATURE DENSITY
0.000	0.000 465.763 1000.204 -0.000	0.000 219.779 XXXXXX	701.040 -34.781 XXXXX	20.000 -.753 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	2.0401 0.0000 200.000	.2929 464.975 31.427	XXXXXX XXXXXX 172.716	0.000 288.160 2.37695-03
57.000	16764.547 465.763 1000.204 45e7.714	0.000 219.779 XXXXXX	714.460 -34.781 XXXXX	-31.792 -.753 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9299 0.0000 200.000	.3023 90.234 14.514	XXXXXX XXXXXX 172.716	16760.947 288.160 2.37695-03

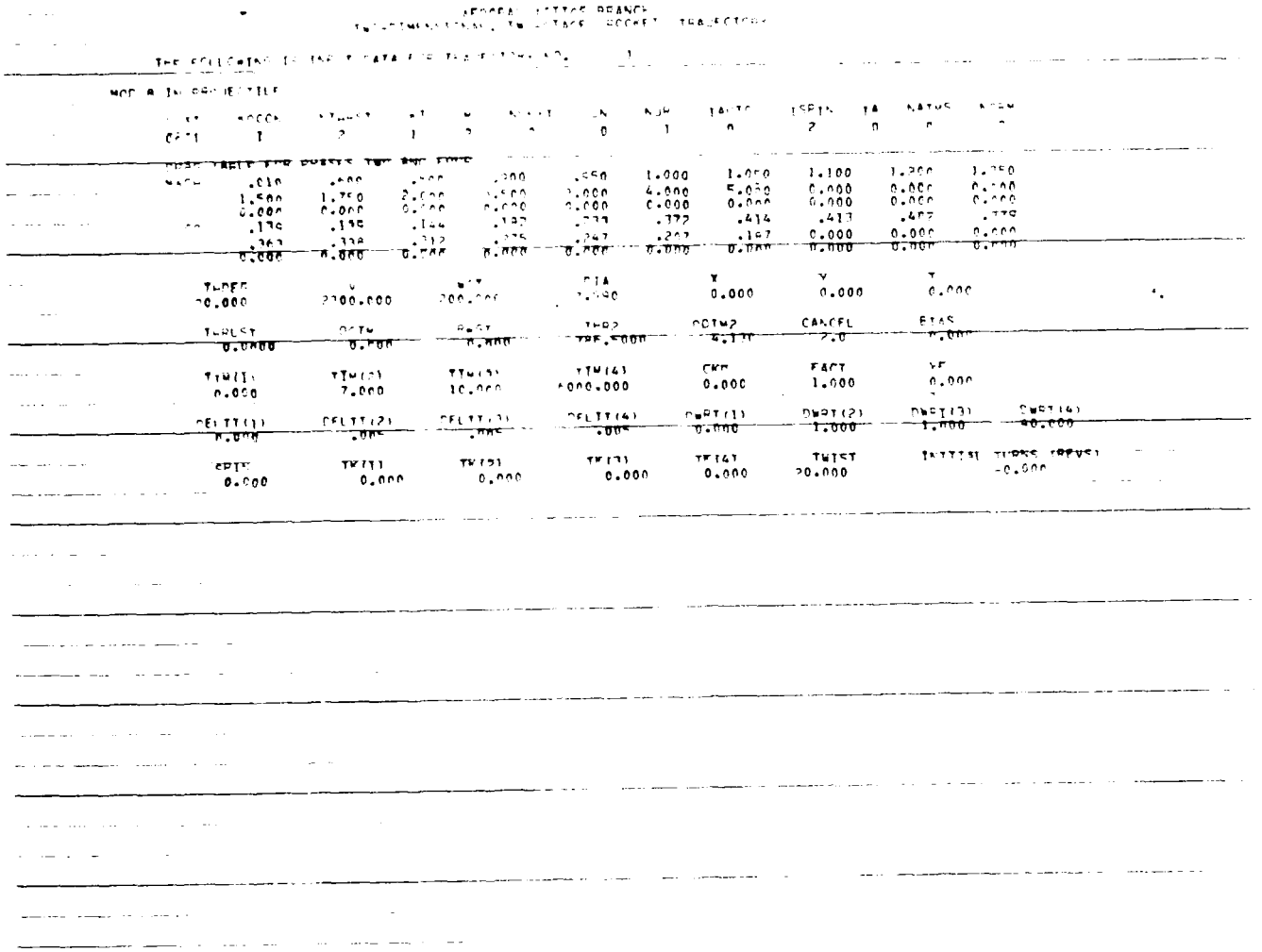
END OF TRAJECTORY NO. 1

[illegible] CORPORATION
[illegible]

[illegible]

SUMMARY OF [illegible]

A/C	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT MACH	INIT CRP FINAL CRP FINAL MACH	INIT CYRO FINAL CYRO MAX ALT CYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO [illegible]
1	0.000 33.000 0.000	20.000 -33.392 200.000	1085.206 1085.206 200.000	0.000 0.000 0.000	0.000 14740.543 0.000	0.000 0.000 0.000	761.040 316.440 7.000



TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

TIME	RANGE X-VELOCITY SEC. RATE TOTAL YAWS	ALTITUDE Y-VELOCITY CYRO STAB	VELOCITY V-VELOCITY DYNAMIC	THETA THETA-DOT RECIPROCAL	NUTATION NU HALF NU FREQ	PRECESSION PSI HALF PSI FREQ	MASS THRUST WEIGHT	CD CDAG CDSP MASS	YAW ERROR YAW ERROR SPIN RPS	GLOBAL DIST TRANSFORMATION DENSITY
0.000	0.000 458.763 10^6.704 -4.488	0.000 239.770 ******	701.040 -34.364 *****	20.000 -.759 *****	*****	*****	2.0601 0.0000 200.000	.2076 477.245 32.013	****** ****** 172.714	0.000 288.150 2.37605-03
11.000	18000.908 458.763 10^6.704 4474.777	0.000 239.770 ******	717.296 -34.364 *****	-99.000 -.759 *****	*****	*****	.2220 0.0000 200.000	.2046 85.411 14.414	****** ****** 172.714	18000.908 288.150 2.37605-03

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
REENTRY TESTS BRANCH

MCH 6 IN ROCKETTEF

SUMMARY OF TRAJECTORIES

NJB	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT WGT	INIT SPIN FINAL SPIN FINAL WGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO STAGTYPE
1	0.000 77.488 0.000	20.000 -33.449 200.000	1085.206 1085.206 200.000	0.000 0.000 0.000	0.000 1440?.904 0.000	0.000 0.000 0.000	701.040 313.774 7.990

AEROBALLISTICS BRANCH
TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

MOD A IN PROJECTILE

NEXT	NCON	NTHRST	KT	M	NUNIT	JN	KJR	IAUTO	ISPIN	TA	NATMS	NCOM
0001	1	2	1	5	5	0	1	0	2	0	0	0

DRAG TABLE FOR PHASES TWO AND FOUR

MACH	.010	.600	.800	.900	.950	1.000	1.050	1.100	1.200	1.350
	1.500	1.750	2.000	3.500	3.000	4.000	5.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CD	.132	.142	.147	.173	.227	.354	.304	.293	.283	.281
	.346	.322	.297	.262	.235	.197	.178	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

THDEG	V	WGT	DIA	X	Y	T
72.000	2300.000	200.000	.990	0.000	0.000	0.000

THRLST	DOTM	RWGT	THR2	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	5000.5000	4.130	2.0	0.000

TTW(1)	TTW(2)	TTW(3)	TTW(4)	CKD	FACT	YF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	40.000

SPIN	YW(1)	YW(2)	YW(3)	YW(4)	TWIST	INITIAL TURNS (PREVS)
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

PRE-FLIGHT OF MAIN STAGE

TIME	RANGE X-DERIV SPIN RATE TOTAL TURNS	ALTITUDE Y-DERIV CYRO STAR	VELOCITY V-DERIV DYNAMIC	THETA TH-DERIV RECIPROCAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MASS THRUST WEIGHT	CD DRAG DRAG/MASS	YAW FREQ YAW FREQ SPIN RPS	PLANT CIRC TEMPERATURE DENSITY
0.000	0.000 640.993 1885.206 -8.000	0.000 262.414 XXXXXX	701.040 -35.101 XXXXX	22.000 -.749 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	2.0401 0.0000 200.000	.2928 448.939 31.427	XXXXXX XXXXXX 172.716	0.000 288.150 2.37695-03
40.000	15227.738 259.769 1885.206 6908.436	160.097 -191.192 XXXXXX	716.718 1.193 XXXXX	-36.456 -1.455 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9329 0.0000 200.000	.2068 90.090 4.417	XXXXXX XXXXXX 172.716	15228.679 287.119 2.34065-03
40.869	15451.982 259.769 1885.206 7058.440	0.000 -191.192 XXXXXX	717.775 1.193 XXXXX	-36.148 -1.455 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9338 0.0000 200.000	.2062 92.726 14.917	XXXXXX XXXXXX 172.716	15451.982 288.150 2.37695-03

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AEROBALLISTICS BRANCH

[illegible] PROJECTILE

SUMMARY OF TRAJECTORIES

N,M	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT WGT	INIT SPIN FINAL SPIN FINAL WGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO [illegible]
1	0.000	27.000	1085.206	0.000	0.000	0.000	701.040
	40.000	-36.148	1085.206	0.000	15451.982	0.000	317.775
	40.000	200.000	200.000	0.000	15227.738	160.097	7.990

AEROBALLISTICS BRANCH
TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

MOD 8 IN PROJECTILE

	KEEP	KCOR	NTHRST	KT	M	NUMTT	JN	NJR	TAUTO	ISPIN	TA	NATMS	NCEM
	PART	1	2	1	2	3	0	1	0	2	0	0	0

FOUR TABLE FOR PHASES TWO AND FOUR

MACH	.810	.600	.800	.900	.950	1.000	1.050	1.100	1.200	1.350
	1.500	1.750	2.000	3.500	3.000	4.000	5.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CD	.137	.137	.137	.173	.222	.354	.304	.293	.287	.281
	.264	.322	.297	.262	.235	.197	.178	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

TGMEG	V	WGT	DTX	X	Y	T
30.000	2350.000	200.000	7.990	0.000	0.000	0.000

TABLST	DOTM	BWGT	THR2	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	786.5000	4.130	2.0	0.000

TTM(1)	TTM(2)	TTM(3)	TTM(4)	CKM	FACT	YF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	40.000

EPIN	TK(1)	TK(2)	TK(3)	TK(4)	TWIST	[illegible] TURNS TRPVS
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

PREFLIGHT OF MAIN STAGE

TIME	RANGE X-DERIV SRT+ RATE TOTAL TURNS	ALTITUDE Y-DERIV CYRO STAB	VELOCITY V-DERIV DYNAMIC	THETA THETADERIV DEFLOPAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MACH THRUST WEIGHT	CD DRAG PROP MASS	YAW ERRC YAW FREQ SPIN RPS	SLANT RIST TEMPERATURE DENSITY
0.000	0.000 473.289 1100.797 -8.788	0.000 244.982 XXXXXX	714.280 -35.811 XXXXX	20.000 -.737 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	2.1049 0.0000 200.000	.2897 661.945 32.457	XXXXXX XXXXXX 176.471	0.000 288.160 2.37695E-03
10.451	1100.797 6869.429	0.000 244.982 XXXXXX	717.211 -35.811 XXXXX	20.919 -.737 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.2892 0.0000 200.000	.2845 91.670 14.747	XXXXXX XXXXXX 176.471	15148.869 288.160 2.37695E-03

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AEROBALLISTICS BRANCH

WITH 6 IN PROJECTILE

SUMMARY OF TRAJECTORIES

NO	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT MOI	INIT SPIN FINAL SPIN FINAL MOI	INIT CYRO FINAL CYRO MAX ALT CYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO ATTEMPTED
1	0.000	20.000	1168.797	0.000	0.000	0.000	716.280
	20.551	-32.819	1108.797	0.000	15140.069	0.000	317.211
	0.000	300.000	300.000	0.000	0.000	0.000	7.500

Section K-5

```
PROJECTILE A INCH W106
      3.5433
    155.0000
    300.0000
  58500.0000
     12.8500
      9.0000
     17.0000
      0.0000
PROJECTILE A INCH W106
      3.5433
    155.0000
    300.0000
  58500.0000
     12.8500
      9.0000
     17.0000
      0.0000

     D = CALIBER
    XL = LENGTH OF PROJECTILE TRAVEL
    VR = CHAMBER VOLUME
     P = MAX. PRESSURE
    XM = PROJECTILE WEIGHT
     C = PROPELLANT WEIGHT
     K = PROPELLANT TYPE
     V = MUZZLE VELOCITY
```

INTERIOR BALLISTICS

PROJECTILE 8 INCH M106

D = 3.5433
XL = 155.0000
V0 = 700.0000
P = 50500.00
XM = 12.65
C = 8.00
K = 17
= 0.00

FOR PROPELLANT M17

F = .436A0E+07, SFC = .7A220E+04
TRAVEL AT MUZZLE = 10.505

TRAVEL AT BURNOUT = 4.217

VELOCITY AT MUZZLE EQUALS 3973.67 FT/SEC

INTERIOR BALLISTICS

PROJECTILE 8 INCH M106

```
D =      3.5433
XL =   155.0000
V0 =   700.0000
P =   62500.00
XM =      12.65
C =        9.00
K =   17
V =        0.00

C/V0 IS GREATER THAN 0.0271, HENCE PROPELLANT MAY NOT BURN SMOOTHLY
FOR PROPELLANT M17

F =          .4368E+07, SFG =          .3423E+04
TRAVEL AT MUZZLE =      11.658

TRAVEL AT BURNOUT =      6.508

VELOCITY AT MUZZLE EQUALS    4054.62 FT/SEC
```

Section K-6

```
LA MOD2 A IN PROJECTILE
 1000.000     0.000          17
12
   .5505
    0.0000  676.0000  891.0000 1116.0000 1339.0000 1562.0000 1786.0000
 2232.0000 3348.0000 5580.0000 10044.0000
2
LA MIN PILE
END REGIN
      0.000     1.787     5.484     8.749    12.960    17.867    24.548
     24.741    28.998    33.335    37.683    43.132    47.405    49.483
     53.598    58.845    63.819    69.685    75.899    79.855    82.575
     85.576    89.291    98.974    94.486   100.718   107.170   113.587
    119.568   124.115   129.781   136.982   144.639   152.591   159.907
    167.788   176.728   180.000
     20.000  1658.519  1658.598   257.835
    .4          1.4          .5          0.0          2.
NUMBER OF RADII IN FIRST LINEAR REGION IS
    880.5    7236.3    9952.7       0.0     100.
NUMBER OF RADII IN LOGARITHMIC REGION IS
      0.0     909.2    2388.7       0.0     100.
NUMBER OF RADII IN SECOND LINEAR REGION IS
     20.000   47.000
    8889.9   8237.8   12342.8       0.0
     6.896   47.000
    82.6     765.2     1146.6       0.0
```

```
LA MOD2 A IN PROJECTILE
 1000.000     0.000     0.000          37
12
     .5905
    0.0000   670.0000  893.0000 1116.0000 1339.0000 1562.0000 1786.0000
 2232.0000 3348.0000 5580.0000 10044.0000
 2
LA MIN PILE
END BEGIN
```

0.000	1.767	5.484	8.748	12.988	17.867	20.548	
24.741	28.990	33.135	37.603	43.132	47.405	49.483	
53.598	58.845	63.919	69.605	75.099	79.655	82.575	
85.576	89.201	90.974	94.486	100.718	107.170	113.567	
119.568	124.115	129.781	136.982	144.639	152.591	159.907	
167.788	176.320	180.000					
25.000	1650.519	1660.330	257.825				

```
        .9        2.3        1.0        0.0
NUMBER OF RADII IN FIRST LINEAR REGION IS    2.
```

943.0	6840.2	8813.0	0.0

```
NUMBER OF RADII IN LOGARITHMIC REGION IS  100.
```

0.0	1862.3	2282.6	0.0

```
NUMBER OF RADII IN SECOND LINEAR REGION IS  100.
```

25.000	42.000		
943.9	7844.8	11016.6	0.0
7.620	42.000		
87.7	728.8	1023.5	0.0

```
LA MOD2 A IN PROJECTILE
00021202
    30.000    47.000
  1000.000     0.000     0.000          37
     0.0000    2.5000    1.2500 2150.0000 2366.6670 2150.0000    1.0000
     1.0000
     0.0000
     2.5000    7.5000    5.0000 2366.6670 2575.0000 2800.0000    1.0000
     1.0000
     0.0000
     7.5000   12.5000   10.0000 2575.0000 2325.0000 2350.0000    1.0000
     1.0000
     0.0000
    12.5000   17.5000   15.0000 2325.0000 2850.0000 2300.0000    1.0000
     1.0000
     0.0000
    17.5000   22.5000   20.0000 2850.0000 3100.0000 3400.0000    1.0000
     1.0000
     0.0000
    22.5000   27.5000   25.0000 3100.0000 2900.0000 2800.0000    1.0000
     1.0000
     0.0000
    27.5000   32.5000   30.0000 2900.0000 3100.0000 3000.0000    1.0000
     1.0000
     0.0000
    32.5000   37.5000   35.0000 3100.0000 3275.0000 3200.0000    1.0000
      .1740
    32.7980
    37.5000   42.5000   40.0000 3275.0000 3450.0000 3350.0000    2.0000
      .0980    1.4530
    31.3210    7.8250
    42.5000   47.5000   45.0000 3450.0000 3550.0000 3550.0000    2.0000
      .1600    5.0550
    36.4000    9.6940
    47.5000   52.5000   50.0000 3550.0000 4200.0000 3550.0000    4.0000
      .2250    1.3510    3.7240   39.2400
    19.0630    9.5170    9.5170    9.5170
    52.5000   57.5000   55.0000 4200.0000 4200.0000 4850.0000    4.0000
      .3120    1.4410    2.8530   50.6010
    65.9320    9.4070    9.4070    9.4070
    57.5000   62.5000   60.0000 4200.0000 3375.0000 3550.0000    7.0000
      .1340    1.3440    3.3440    7.4660    8.0700   43.7780  973.9730
   161.1950    9.4660   18.9820    9.4660   18.9820   18.9820    9.4660
    62.5000   67.5000   65.0000 3375.0000 3350.0000 3200.0000   11.0000
      .2170    1.4320    3.3840    7.2970   10.9610   16.1630   26.5680
    45.8970   92.4410  100.0990  210.2100
   113.7910    9.4660   18.9820    9.4660    9.4660   28.4480    9.4660
    18.9820    9.4660    9.4660    9.4660
    67.5000   72.5000   70.0000 3350.0000 3625.0000 3500.0000   17.0000
      .1270    1.4940    2.8510   13.8230   19.4800   29.0090   40.2670
    82.9340   92.7720  108.4450  141.4290  171.1710  236.8920  259.2580
   390.3900  487.4860  539.5410
   179.9710   18.9480    9.4740    9.4740    9.4740    9.4740   28.4230
     9.4740    9.4740   18.9480   18.9480    9.4740   18.9480    9.4740
     9.4740    9.4740    9.4740
    72.5000   77.5000   75.0000 3625.0000 3825.0000 3750.0000   13.0000
      .0970    1.5140    2.8580    5.5050    9.8410   12.0120   30.7130
    42.7630  103.1920  172.1710  272.0000  438.4380  571.0000
   180.0380   37.8920   37.8920    9.4620    9.4620    9.4620   37.8920
     9.4620    9.4620    9.4620   28.4290    9.4620   28.4290
    77.5000   82.5000   80.0000 3825.0000 4200.0000 3900.0000   18.0000
      .2240    1.5400    3.1540    7.7990    8.7710   11.9000   16.2250
    23.3420   30.7950   43.0420   57.7780   78.2610  113.4470  179.0000
   435.2820  820.0000 1117.5760 2426.4260
   246.3890   37.8840   47.3580    9.4710   18.9430   28.4150    9.4710
```

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18.9430	28.4150	47.3580	9.4710				
82.5000	87.5000	85.0000	4200.0000	4500.0000	4500.0000	14.0000	
.1920	1.4570	3.9910	6.1600	12.7780	31.2250	61.4620	
108.1080	175.1740	286.2850	317.3180	447.4470	618.1660	1404.4050	
350.5310	37.8920	47.3960	28.4500	18.9460	18.9460	9.4420	
9.4420	9.4420	9.4420	9.4420	9.4420	56.8380	9.4420	
87.5000	92.5000	90.0000	4500.0000	4425.0000	4500.0000	15.0000	
.1530	1.4770	3.3180	7.1430	12.4330	17.0530	29.8800	
44.5470	55.2990	87.4380	120.1200	182.1830	308.3090	853.3330	
1213.2130							
417.2760	9.4870	85.3840	28.4610	18.9740	28.4610	37.9480	
9.4870	37.9480	9.4870	9.4870	9.4870	9.4870	56.9220	
9.4870							
92.5000	97.5000	95.0000	4425.0000	3850.0000	4350.0000	22.0000	
.1030	1.4420	3.4260	6.6070	13.1430	18.0360	20.9820	
30.6560	41.8120	51.3720	65.0720	77.6790	84.3630	91.3300	
108.6670	129.1290	170.3330	243.3780	420.2890	618.0000	1383.7230	
2387.6670							
369.6870	47.3960	37.9170	9.4790	47.3960	18.9580	9.4790	
47.3960	75.8330	9.4790	18.9580	9.4790	9.4790	9.4790	
28.4380	9.4790	28.4380	18.9580	18.9580	56.8750	47.3960	
28.4380							
97.5000	102.5000	100.0000	3850.0000	3425.0000	3350.0000	24.0000	
.1020	1.4390	3.5110	6.7380	8.7990	11.8400	17.3200	
22.8170	30.3770	43.5190	66.0970	74.4230	87.3360	95.9840	
104.2760	128.4360	178.1110	225.0560	267.1440	350.7780	446.2770	
758.8330	1485.7840	4115.7740					
767.6540	123.1770	132.7750	184.1880	9.3980	37.9930	37.9930	
28.3950	56.7890	47.3910	37.9930	28.3950	18.9960	37.9930	
37.9930	18.9960	85.3840	37.9930	47.3910	85.1840	18.9960	
56.7890	66.3870	75.7860					
102.5000	107.5000	105.0000	3425.0000	3200.0000	3500.0000	14.0000	
.2220	1.5020	2.6430	7.1260	9.8110	11.7330	15.7060	
28.6470	39.4400	54.2550	77.5590	192.1920	471.4710	509.5110	
265.2940	9.4500	9.4500	9.4500	9.4500	28.4320	9.4500	
9.4500	9.4500	9.4500	9.4500	9.4500	9.4500	9.4500	
107.5000	112.5000	110.0000	3200.0000	2725.0000	2900.0000	7.0000	
.0980	1.1420	4.8020	33.3540	37.4380	54.8560	200.2010	
123.1170	9.4690	18.9570	9.4690	9.4690	9.4690	9.4690	
112.5000	117.5000	115.0000	2725.0000	2550.0000	2550.0000	7.0000	
.1310	1.3420	11.2790	20.5400	78.8800	241.2400	711.1440	
85.1520	9.4560	18.9280	9.4560	9.4560	9.4560	18.9280	
117.5000	122.5000	120.0000	2550.0000	2650.0000	2550.0000	7.0000	
.2360	2.8420	5.8770	9.6100	11.2010	25.6070	327.3270	
56.6370	9.4300	9.4300	9.4300	9.4300	9.4300	9.4300	
122.5000	127.5000	125.0000	2650.0000	2750.0000	2750.0000	7.0000	
.1870	1.6940	4.5740	5.3240	8.0690	92.6940	210.2100	
151.6480	18.9870	9.4590	9.4590	9.4590	9.4590	9.4590	
127.5000	132.5000	130.0000	2750.0000	2825.0000	2750.0000	13.0000	
.2120	1.4290	2.3030	5.6670	10.8900	19.2400	31.4320	
35.2760	97.4190	133.1320	158.1590	298.2970	426.4260		
680.7590	66.2100	9.4200	28.3500	28.3500	9.4200	9.4200	
9.4200	9.4200	9.4200	9.4200	9.4200	9.4200		
132.5000	137.5000	135.0000	2825.0000	2825.0000	2900.0000	9.0000	
.2170	1.3410	10.4800	16.6160	20.3210	25.9160	175.4120	
296.2970	509.5110						
811.8250	54.7730	9.1130	9.1130	9.1130	9.1130	18.2260	
9.1130	9.1130						
137.5000	142.5000	140.0000	2825.0000	2625.0000	2750.0000	10.0000	
.2770	1.4380	2.7430	7.6970	10.2400	22.9840	34.5740	
89.8410	99.3600	102.1020					
543.7370	39.4210	39.4210	7.8840	7.8840	15.7680	7.8840	
7.8840	7.8840	7.8840					
142.5000	147.5000	145.0000	2625.0000	2525.0000	2500.0000	4.0000	
.2080	1.4000	2.5470	40.0190				

```
 [illegible]  [illegible]  [illegible]  [illegible]
 147.5000  152.5000  150.0000 2525.0000 2550.0000 2550.0000    5.0000
    .1330    1.1560    2.5730    7.6790   19.2880
 345.9760  21.6260  14.2200    5.4060    5.4060
 152.5000  157.5000  155.0000 2550.0000 2600.0000 2550.0000    8.0000
    .2430    1.4250    3.1930    6.7060   12.2380   32.8530  136.1350
 481.4800
 213.5750  26.1640  26.1640    4.3510    8.7310    4.3510    4.3510
   4.3510
 157.5000  162.5000  160.0000 2600.0000 2675.0000 2650.0000   12.0000
    .2430    1.3920    3.6430    6.8360    8.9210   12.8530   17.2170
  41.7990  92.3120  121.1200  253.2520  345.3450
 209.4940  16.0060  29.6610  20.2680    6.7560    3.3620   13.5120
   6.7560    3.3620    3.3620    3.3620    3.3620
 162.5000  167.5000  165.0000 2675.0000 2600.0000 2700.0000   16.0000
    .2940    1.3220    2.8420    6.5220    9.3960   12.0480   17.9580
  23.4140  31.4490  42.3990  56.6760  65.1670  74.1180  80.5320
 116.9520  149.1500
 144.4750  19.6460  44.9780  12.2370    4.8890   14.4970   19.5850
   4.8890    4.8890    4.8890    2.4600    7.3480    4.8890    2.4600
   4.8890    2.4600
 167.5000  172.5000  170.0000 2600.0000 2575.0000 2500.0000   23.0000
    .2950    1.5850    3.4760    6.4470    9.2070   12.3730   16.8670
  23.4680  31.1180  47.9270  58.1110  64.8170  77.1710  85.7980
  97.9190  107.4670  175.9120  235.3820  386.3810  492.4920  529.5260
1661.6610 2124.1230
 107.9160  16.7270  13.6840  16.7270    4.5540    6.0870    7.5970
   3.0430    6.0870    3.0430    1.5110    3.0430    3.0430    3.0430
   1.5110    4.5540    3.0430    3.0430    1.5110    1.5110    1.5110
   1.5110    1.5110
 172.5000  177.5000  175.0000 2575.0000 3116.6670 2650.0000   24.0000
    .3100    1.4070    3.4280    6.1870    9.1070   12.2300   17.6420
  21.6800  29.4330  39.8260  54.2970  63.0130  73.3570  88.0060
  92.9890  112.5880  138.7140  174.3330  230.3540  278.3610  330.3340
 403.7980  619.1660 1539.4710
 111.6720  23.7920  29.6110  17.4840    6.7980    9.7070    8.2660
   5.3160  16.1970    6.7980    2.4200    2.9090    1.4680     .9790
   2.4200    3.3990    4.8670    5.8190    2.4200     .9790    2.4200
    .9790    2.9090    7.7760
 177.5000  180.0000  178.7500 3116.6670 3350.0000 3350.0000   21.0000
    .2380    1.4240    3.3130    6.7570    8.2670   11.9800   17.9230
  28.9340  29.9120  41.5730  59.9610  61.9690  72.7330  110.4450
 128.4360  175.1740  231.2310  414.4140  890.2230 1515.5000 2664.1670
  17.4000    1.6720    3.3470    1.0020     .3330    1.3390    1.0020
    .6690    1.3390    2.0080     .3330     .6690    1.0020     .6690
    .6690     .3330     .3330     .3330    1.3390    2.0080    1.3390
0
12
1
    .5905
  11.8000
   0.0000  670.0000  893.0000 1116.0000 1339.0000 1562.0000 1786.0000
2232.0000 3348.0000 5580.000010044.0000
    .5300     .5400     .5600     .6200     .6800     .7000     .7000
    .6800     .6400     .6000     .5600
2
0
0
0
1
0
LA MONZ A IN PROJECTILE
00021202
   25.000   42.000
 1000.000    0.000    0.000       37
    0.0000   2.5000   1.2500 2150.0000 2366.6670 2150.0000    1.0000
```

1.0000						
0.0000						
2.5000	7.5000	5.0000	2366.6670	2575.0000	2800.0000	1.0000
1.0000						
0.0000						
7.5000	12.5000	10.0000	2575.0000	2325.0000	2350.0000	1.0000
1.0000						
0.0000						
12.5000	17.5000	15.0000	2325.0000	2850.0000	2300.0000	1.0000
1.0000						
0.0000						
17.5000	22.5000	20.0000	2850.0000	3100.0000	3400.0000	1.0000
1.0000						
0.0000						
22.5000	27.5000	25.0000	3100.0000	2900.0000	2800.0000	1.0000
1.0000						
0.0000						
27.5000	32.5000	30.0000	2900.0000	3100.0000	3000.0000	1.0000
1.0000						
0.0000						
32.5000	37.5000	35.0000	3100.0000	3275.0000	3200.0000	1.0000
.1760						
32.7980						
37.5000	42.5000	40.0000	3275.0000	3450.0000	3350.0000	2.0000
.0980	1.4530					
31.3210	7.8250					
42.5000	47.5000	45.0000	3450.0000	3550.0000	3550.0000	2.0000
.1600	5.0550					
36.4000	9.0940					
47.5000	52.5000	50.0000	3550.0000	4200.0000	3550.0000	4.0000
.2250	1.3510	3.7240	30.2400			
19.0630	9.5170	9.5170	9.5170			
52.5000	57.5000	55.0000	4200.0000	4200.0000	4850.0000	4.0000
.3120	1.4410	2.8530	50.6010			
65.9320	9.4070	9.4070	9.4070			
57.5000	62.5000	60.0000	4200.0000	3375.0000	3550.0000	7.0000
.1340	1.3660	2.3940	7.4460	9.8700	43.7780	973.9730
161.1950	9.4660	18.9820	9.4660	18.9820	18.9820	9.4660
62.5000	67.5000	65.0000	3375.0000	3350.0000	3200.0000	11.0000
.2170	1.4330	3.3840	7.2970	10.9610	16.1630	26.5680
45.8970	92.4410	100.0990	210.2100			
113.7910	9.4660	18.9820	9.4660	9.4660	28.4480	9.4660
18.9820	9.4660	9.4660	9.4660			
67.5000	72.5000	70.0000	3350.0000	3625.0000	3500.0000	17.0000
.1270	1.4940	2.0510	13.8230	19.4800	29.0090	48.2670
82.9340	92.7720	108.4450	141.4290	171.1710	236.8820	259.2580
390.3980	487.4860	539.5410				
179.9710	18.9480	9.4740	9.4740	9.4740	9.4740	28.4230
9.4740	9.4740	18.9480	18.9480	9.4740	18.9480	9.4740
9.4740	9.4740	9.4740				
72.5000	77.5000	75.0000	3625.0000	3825.0000	3750.0000	13.0000
.0970	1.5180	2.8580	5.5050	9.8410	12.0120	30.7130
42.7630	103.1020	172.1710	232.0000	438.4380	571.0000	
180.0380	37.8920	37.8920	9.4620	9.4620	9.4620	37.8920
9.4620	9.4620	9.4620	28.4290	9.4620	28.4290	
77.5000	82.5000	80.0000	3825.0000	4200.0000	3900.0000	18.0000
.2240	1.5400	3.1540	7.7990	8.7710	11.9000	16.2250
23.3420	38.7950	43.0420	57.7780	78.2610	113.4470	179.0000
435.2820	820.0060	1117.5760	2426.4260			
246.3890	37.8860	47.3580	9.4710	18.9430	28.4150	9.4710
9.4710	37.8860	9.4710	9.4710	18.9430	28.4150	28.4150
18.9430	28.4150	47.3580	9.4710			
82.5000	87.5000	85.0000	4200.0000	4500.0000	4500.0000	14.0000
.1920	1.4530	3.9910	6.1600	12.7780	31.2250	61.4620
188.1080	175.1740	286.2850	317.3180	447.4470	618.1660	1404.4050
350.5310	37.8920	47.3960	28.4500	18.9460	18.9460	9.4420

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
87.5000	92.5000	90.0000	4500.0000	4425.0000	4500.0000	15.0000
.1530	1.6730	3.3180	7.1430	12.4330	17.0530	29.8800
46.5970	55.7990	87.4380	120.1200	182.1830	308.7890	853.3330
1213.2130						
417.2760	9.4870	85.3840	28.4610	18.9740	28.4610	37.9480
9.4870	37.9480	9.4870	9.4870	9.4870	9.4870	56.9220
9.4870						
92.5000	97.5000	95.0000	4425.0000	3850.0000	4350.0000	22.0000
.1030	1.5470	3.4260	6.6070	13.1430	18.0160	28.9820
30.6560	41.8120	51.3720	65.0720	77.6790	84.7630	91.3380
108.6070	129.1290	170.3330	243.3780	420.2890	618.0000	1383.7230
2386.6670						
369.6870	47.3960	37.9170	9.4790	47.3960	18.9580	9.4790
47.3960	75.8330	9.4790	18.9580	9.4790	9.4790	9.4790
28.4380	9.4790	28.4380	18.9580	18.9580	56.8750	47.3960
28.4380						
97.5000	102.5000	100.0000	3850.0000	3425.0000	3350.0000	24.0000
.1820	1.6390	3.5110	6.7180	8.7990	11.8900	17.3200
22.8170	30.3770	43.5190	66.8970	74.4230	87.3360	95.9840
104.2740	128.4360	178.1110	225.0560	267.1460	350.7780	446.2770
758.8330	1485.7840	4115.7340				
767.6540	123.1770	132.7750	104.1800	9.3940	37.9930	37.9930
28.3950	56.7890	47.3910	37.9930	28.3950	18.9960	37.9930
37.9930	18.9960	85.3840	37.9930	47.3910	85.3840	18.9960
56.7890	66.3870	75.7860				
102.5000	107.5000	105.0000	3425.0000	3200.0000	3500.0000	14.0000
.2220	1.5020	2.6430	7.1260	9.8110	11.7330	15.7060
28.4470	39.6400	54.2550	77.5590	192.1920	471.4710	509.5110
265.2940	9.4580	9.4580	9.4580	9.4580	28.4320	9.4580
9.4580	9.4580	9.4580	9.4580	9.4580	9.4580	9.4580
107.5000	112.5000	110.0000	3200.0000	2725.0000	2900.0000	7.0000
.0980	1.1620	4.8020	33.3540	37.4380	54.8560	200.2010
123.1170	9.4690	18.9570	9.4690	9.4690	9.4690	9.4690
112.5000	117.5000	115.0000	2725.0000	2550.0000	2550.0000	7.0000
.1310	1.3420	11.2790	28.5800	78.8800	241.2400	711.1440
85.1520	9.4560	18.9120	9.4560	9.4560	9.4560	18.9120
117.5000	122.5000	120.0000	2550.0000	2650.0000	2550.0000	7.0000
.2360	2.6420	5.8770	9.6100	11.2610	25.6070	327.3270
56.6370	9.4300	9.4300	9.4300	9.4300	9.4300	9.4300
122.5000	127.5000	125.0000	2650.0000	2750.0000	2750.0000	7.0000
.1870	1.6940	4.5740	5.3240	8.0690	92.6940	210.2100
151.6480	18.9620	9.4590	9.4590	9.4590	9.4590	9.4590
127.5000	132.5000	130.0000	2750.0000	2825.0000	2750.0000	13.0000
.2120	1.4290	2.3030	5.6670	10.8900	19.2400	31.4320
35.2760	97.4190	133.1320	158.1590	298.2970	426.4260	
680.7590	66.9100	9.4200	28.3500	28.3500	9.4200	9.4200
9.4200	9.4200	9.4200	9.4200	9.4200	9.4200	
132.5000	137.5000	135.0000	2825.0000	2825.0000	2900.0000	9.0000
.2170	1.3410	10.4800	16.6160	20.3210	25.9160	175.4120
296.2970	509.5110					
811.8250	54.7730	9.1130	9.1130	9.1130	9.1130	18.2260
9.1130	9.1130					
137.5000	142.5000	140.0000	2825.0000	2625.0000	2750.0000	10.0000
.2770	1.4380	2.7430	7.6370	10.2400	22.9540	34.5740
89.8410	99.3600	102.1020				
543.7370	39.6210	39.4210	7.8840	7.8840	15.7680	7.8840
7.8840	7.8840	7.8840				
142.5000	147.5000	145.0000	2625.0000	2525.0000	2500.0000	4.0000
.2080	1.6000	2.5470	40.0190			
552.1300	32.4710	19.7100	13.1610			
147.5000	152.5000	150.0000	2525.0000	2550.0000	2550.0000	5.0000
.1330	1.3580	2.5730	7.6790	19.2880		
345.9760	21.6260	16.2200	5.4060	5.4060		
152.5000	157.5000	155.0000	2550.0000	2600.0000	2550.0000	8.0000
.2430	1.4250	3.1930	6.7060	12.2380	32.8530	136.1350

481.4000							
213.5750	26.1640	24.1640	4.3510	8.7310	4.3510	4.3510	
4.3510							
157.5000	162.5000	160.0000	2600.0000	2675.0000	2650.0000	12.0000	
.2430	1.3920	3.6430	6.8360	8.9210	12.8530	17.2170	
41.7990	92.3120	121.1200	253.2520	345.3450			
209.4940	16.9050	23.6410	28.2480	6.7560	3.3620	13.5120	
6.7560	3.3620	3.3620	3.3620	3.3620			
162.5000	167.5000	165.0000	2675.0000	2600.0000	2700.0000	16.0000	
.2440	1.3720	2.8620	6.5220	9.3960	12.8480	17.9580	
23.4140	31.4490	42.3990	56.6760	65.1670	74.1380	80.5320	
116.9420	149.1580						
144.4750	19.5850	48.9780	12.2370	4.8890	14.4970	19.5850	
4.8890	4.8890	4.8890	2.4600	7.3480	4.8890	2.4600	
4.8890	2.4600						
167.5000	172.5000	170.0000	2600.0000	2575.0000	2500.0000	23.0000	
.2950	1.5850	3.4760	6.4470	9.2070	12.9730	16.8670	
23.4000	31.1100	47.9270	58.1110	64.8170	77.1710	85.7980	
97.9190	107.6670	175.9120	235.3820	380.3810	492.4920	529.5290	
1661.6610	2124.1210						
107.9160	16.7270	11.6840	16.7270	4.5540	6.0870	7.5970	
3.0430	6.0870	3.0430	1.5110	3.0430	3.0430	3.0430	
1.5110	4.5540	3.0430	3.0430	1.5110	1.5110	1.5110	
1.5110	1.5110						
172.5000	177.5000	175.0000	2575.0000	3116.6670	2650.0000	24.0000	
.3100	1.6670	3.4780	6.1870	9.1070	12.7300	17.6420	
21.6800	29.4330	39.8260	54.2970	63.0130	73.3570	88.0060	
92.9890	112.5880	138.7140	174.3330	230.3540	278.3610	330.3340	
403.7980	619.1460	1539.4710					
111.6720	23.7920	29.6110	17.4840	6.7980	9.7070	8.2660	
5.8190	10.1970	6.7980	2.4200	2.9090	1.4680	.9790	
2.4200	3.3990	4.8670	5.8190	2.4200	.9790	2.4200	
.9790	2.9090	7.7760					
177.5000	180.0000	178.7500	3116.6670	3350.0000	3350.0000	21.0000	
.2380	1.4240	3.3130	6.7570	8.2670	11.9800	17.9230	
20.9340	29.9120	43.5730	59.9610	61.9690	72.7330	110.4450	
128.4360	175.1740	231.2310	414.4140	890.2230	1515.4000	2669.1670	
17.4800	1.4720	3.3470	1.0020	.3330	1.3390	1.0020	
.6690	1.3390	2.0080	.3330	.6690	1.0020	.6690	
.6690	.3330	.3330	.3330	1.3390	2.0080	1.3390	
0							
12							
1							
.5905							
11.0000							
0.0000	670.0000	893.0000	1116.0000	1330.0000	1562.0000	1786.0000	
2232.0000	3348.0000	5580.0000	10044.0000				
.5300	.5400	.5600	.6200	.6800	.7000	.7000	
.6000	.6400	.6800	.5600				
2							
0							
0							
0							
1							
0							

Section K-7

```
PROJECTILE A INCH W106
    3.5433
  155.0000
  300.0000
<0>90.0000
   12.8500
    8.4000
   17.0000
    0.0000

      D = CALIBER
      XL = LENGTH OF PROJECTILE PRIMER
      V0 = CHAMBER VOLUME
      P = MAX. PRESSURE
      XM = PROJECTILE WEIGHT
      C = PROPELLANT WEIGHT
      K = PROPELLANT TYPE
      V = MUZZLE VELOCITY
```

INTERIOR BALLISTICS

PROJECTILE 8 INCH M106

D = 8.5433
XL = 155.0000
V0 = 700.0000
P = 50500.00
XM = 12.65
C = 8.58
K = 17
V = 0.00

C/V0 IS GREATER THAN 0.0271, HENCE PROPELLANT MAY NOT BURN SMOOTHLY
FOR PROPELLANT M17

F = .4368OE+07, SFG = .3422OE+04
TRAVEL AT MUZZLE = 11.141

TRAVEL AT BURNOUT = 5.339

VELOCITY AT MUZZLE EQUALS 4071.20 FT/SEC

Section K-8

0.	0.	0.	.5	.4167	.4056	.625	.5266
.5135	.75	.6417	.6273	.875	.7547	.7387	1.
.866	.8466	1.25	1.1147	1.0966	1.5	1.3647	1.3466
1.75	1.6147	1.5966	2.	1.8647	1.8466	2.25	2.1147
2.0966	2.5	2.3647	2.3466	2.75	2.6147	2.5966	3.
2.8647	2.8466	3.25	3.1147	3.0966	3.5	3.3647	3.3466
3.75	3.6147	3.5966	4.	3.8647	3.8466	4.25	4.1147
4.0966	4.5	4.3647	4.3466	4.75	4.6147	4.5966	5.
4.8647	4.8466	5.25	5.1147	5.0966	5.5	5.3647	5.3466
5.75	5.6147	5.5966	6.	5.8647	5.8466		
6.	5.625	1.625	43990.	6.	6.5	2.5	82100.
2.5	7.25	3.	112500.	4.5	8.	4.625	152000.
5.	9.	4.25	197100.	5.	9.5	4.75	231100.
5.5	10.	4.75	244400.	6.	11.625	5.875	351300.

.0100	.2830	40000.0000		.2780	10.3600	.2460	.0578
26.0000	36.0000	7635.7000	32520.0000		.0031	5000.0000	11.2500
.0010	.0010	.0020	.0100		2.0000	.6500	3.5000
3.5000	0.0000	1000.0000	2.0000		60.0000	1.5000	85.0000
77.0000	1.0000	1.0000	1200.0000		0	1	0
.0100	.2830	40000.0000		.2780	10.3600	.2460	.0578
26.0000	36.0000	7635.7000	32520.0000		.0031	5000.0000	11.2500
.0010	.0010	.0020	.0100		2.0000	.6500	3.5000
3.5000	0.0000	1000.0000	2.0000		60.0000	1.5000	85.0000
77.0000	0.0000	1.0000	1200.0000		0	1	0

Section K-9

IM 483 SPINNER ALL DALE BODY

.0100 .6000 .8000 .9000 .9500 1.0000 1.0500 1.1000
1.2000 1.3500 1.5000 1.7500 2.0000 2.5000 3.0000 4.0000
5.0000
0.0000 57.3000

1.7022 1.7048 1.7579 1.8185 1.9839 2.0508 2.2155 2.2741
2.3584 2.4447 2.5698 2.7128 2.8244 2.9583 3.0362 2.9973
2.9313

.0100 .6000 .8000 .9000 .9500 1.0000 1.0500 1.1000
1.2000 1.3500 1.5000 1.7500 2.0000 2.5000 3.0000 4.0000
5.0000
0.0000 57.3000
5.1865 5.9850 7.4488 9.2932 11.4604 14.8828 15.4532 15.5673
15.6814 15.7954 16.0236 16.2517 16.4799 16.7080 16.8221 16.7080
16.5940
5.1865 5.9850 7.4488 9.2932 11.4604 14.8828 15.4532 15.5673
15.6814 15.7954 16.0236 16.2517 16.4799 16.7080 16.8221 16.7080
16.5940

.0100 .6000 .8000 .9000 .9500 1.0000 1.0500 1.1000
1.2000 1.3500 1.5000 1.7500 2.0000 2.5000 3.0000 4.0000
5.0000
0.0000 57.3000
.9617 .8896 .7363 .6952 .7337 1.1884 1.3503 1.4604
1.5521 1.6847 1.8054 1.9588 2.0653 2.2092 2.2748 2.2504
2.2150
.9617 .8896 .7363 .6952 .7337 1.1884 1.3503 1.4604
1.5521 1.6847 1.8054 1.9588 2.0653 2.2092 2.2748 2.2504
2.2150

.0100 .6000 .8000 .9000 .9500 1.0000 1.0500 1.1000
1.2000 1.3500 1.5000 1.7500 2.0000 2.5000 3.0000 4.0000
5.0000
0.0000 57.3000

.8842 .7271 .6189 .6169 .6169 .6169 .6169 .6169
.6169

.0100 .6000 .8000 .9000 .9500 1.0000 1.0500 1.1000
1.2000 1.3500 1.5000 1.7500 2.0000 2.5000 3.0000 4.0000
5.0000
0.0000 57.3000
.0200 .0200 .0191 .0161 .0140 .0132 .0132 .0132
.0132 .0132 .0132 .0127 .0121 .0116 .0110 .0102
.0105
.0200 .0200 .0191 .0161 .0140 .0132 .0132 .0132
.0132 .0132 .0132 .0127 .0121 .0116 .0110 .0102
.0105

.0100 .6000 .8000 .9000 .9500 1.0000 1.0500 1.1000
1.2000 1.3500 1.5000 1.7500 2.0000 2.5000 3.0000 4.0000
5.0000
0.000 1.000 2.000 5.000 57.300
2.4901 2.8561 3.0895 3.3884 3.4881 3.5878 3.6874 3.7871
3.9366 4.0861 4.2356 4.4548 4.4548 4.4548 4.4548 4.4548
4.4548
2.4901 2.8561 3.0895 3.3884 3.4881 3.5878 3.6874 3.7871
3.9366 4.0861 4.2356 4.4548 4.4548 4.4548 4.4548 4.4548
4.4548
3.2888 3.2888 3.4881 3.7871 3.8569 3.9366 4.0063 4.0861
4.1458 4.2455 4.3352 4.5046 4.5046 4.5046 4.5046 4.5046
4.5046
4.0457 4.0457 4.1494 4.4606 4.5125 4.5644 4.5951 4.6059
4.6266 4.6474 4.6889 4.6889 4.6889 4.6889 4.6889 4.6889
4.6889
4.0457 4.0457 4.1494 4.4606 4.5125 4.5644 4.5951 4.6059
4.6266 4.6474 4.6889 4.6889 4.6889 4.6889 4.6889 4.6889
4.6889
.0100 .6000 .8000 .9000 .9500 1.0000 1.0500 1.1000
1.2000 1.3500 1.5000 1.7500 2.0000 2.5000 3.0000 4.0000
5.0000
0.0000 57.3000
.1408 .1408 .1455 .1813 .2302 .2670 .2753 .2747
.3645 .3435 .3284 .3044 .2792 .2447 .2171 .1797
.1611
.1408 .1408 .1455 .1813 .2302 .2670 .2753 .2747
.3645 .3435 .3284 .3044 .2792 .2447 .2171 .1797
.1611

```
*END
CARD
 XM 493 SPINNER    ALL DALE  BODY
12222211211000110 0 0
 517  2  1 0 0          0.000     0.000
0000001
  270.000     0.000     0.000    11.250     0.000     0.000     0.000     0.000
    6.092   103.400   975.100     0.000     0.000   602.410     0.000     0.000
  515.000  6356.000    22.470     0.000     0.000   515.000  6356.000    22.470
    0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
  515.000  6356.000    22.470     0.000     0.000   515.000  6356.000    22.470
    0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
    0.000     0.000     0.000     0.000     0.000     0.000   103.400     0.000
    0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
    0.000     0.000     0.000     0.000     0.000     0.000     1.000     0.000
    0.000     0.000     0.000     0.000     0.000   328.000     0.000     0.000
```

XM 483 SPINNER ALL DALE BODY

MISSILE INPUT DATA FOR SIX DEGREE OF FREEDOM TRAJECTORY

LONGITUDE,DEGREES ** 270.000
LATITUDE,DEGREES ** 0.000
LATERAL ORIENTATION,DEGREES ** 0.000
QUADRANT ELEVATION,DEGREES ** 11.250

AXIAL MISSILE VELOCITY,FT/SEC ** 975.100
MISSILE SPIN RATE,RADIAN/SEC ** 602.610
MISSILE PITCH RATE,RADIAN/SEC ** 0.0000
MISSILE YAW RATE,RADIAN/SEC ** 0.0000

DIAMETER,INCHES ** 6.092
WEIGHT,LBS ** 103.400
CENTER OF GRAVITY FROM NOSE,INCHES ** 22.470
AXIAL MOMENT OF INERTIA,LBS-SQ.IN. ** 515.000
TRANSVERSE MOMENT OF INERTIA,LBS-SQ.IN. ** 6356.000

DENSITY MULTIPLYER ** 1.00000
VY MISSILE,FT/SEC ** 0.0000
FINAL CENTER OF GRAVITY FROM NOSE,INCHES ** 22.470

RANGE WIND,IF CONSTANT,FT/SEC ** 0.000
VERTICAL WIND,IF CONSTANT,FT/SEC ** 0.000

BOOSTER ROCKET DATA

BURNING RATE,LBS/SEC ** 0.0000
SPECIFIC IMPULSE,LB-SEC/LB ** 0.000
NOZZLE DIAMETER,INCHES ** 0.000
THRUST MODIFIER ** 0.000

AXIAL THRUST MALALIGNMENT ANGLE,DEGREES ** 0.000
LATERAL THRUST MALALIGNMENT ANGLE,DEGREES ** 0.000
THRUST MALALIGNMENT DISTANCE RX,INCHES ** 0.000
THRUST MALALIGNMENT DISTANCE RY,INCHES ** 0.000
THRUST MALALIGNMENT DISTANCE RZ,INCHES ** 0.000
TORQUE MOMENT ARM,INCHES ** 0.0000
SEPARATION THRUST,LBS ** 0.000

VX MISSILE,FT/SEC ** 0.0000
FINAL AXIAL MOMENT OF INERTIA,LBS-SQ.IN. ** 515.000
FINAL TRANSVERSE MOMENT OF INERTIA,LBS-SQ.IN. ** 6356.000

CROSS WIND,IF CONSTANT,FT/SEC ** 0.000
CUT OFF ALTITUDE,FEET ** 328.0000

	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7
FORM FACTORS **	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PRINT-OUT RATE **	0.000	0.000	0.000	0.000	0.000	0.000	1.000
ITTERATION RATE **	.000000	.000000	.000000	.000000	.000000	.000000	.001000
PHASE (C.O.) TIME **	0.000	0.000	0.000	0.000	0.000	0.000	

RANGE, ALTITUDE AND DEFLECTION ARE IN METERS

```
                               BALLISTIC COEFFICIENTS AND FORCE CENTERS

                                     NORMAL FORCE COEFFICIENTS

    MACH NOS.     .0100        .6000        .8000        .9000        .9500       1.0000       1.0500       1.1000
                 1.2000       1.3500       1.5000       1.7500       2.0000       2.5000       3.0000       4.0000
                 5.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     ANGLES
       OF                                          COEFFICIENTS
     ATTACK
      0.00      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     57.30       1.7022       1.7068       1.7579       1.8385       1.9839       2.0908       2.2155       2.2741
                 2.3586       2.4447       2.5690       2.7128       2.8246       2.9583       3.0262       2.9973
                 2.9313      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     -0.00      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     -0.00      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     -0.00      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000

                                     YAW DAMPING COEFFICIENTS

    MACH NOS.     .0100        .6000        .8000        .9000        .9500       1.0000       1.0500       1.1000
                 1.2000       1.3500       1.5000       1.7500       2.0000       2.5000       3.0000       4.0000
                 5.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     ANGLES
       OF                                          COEFFICIENTS
     ATTACK
      0.00       5.1865       5.9850       7.4680       9.2932      11.4606      14.8828      15.4532      15.5473
                15.6814      15.7954      16.0236      16.2517      16.4799      16.7080      16.8221      16.7080
                16.5940      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     57.30       5.1865       5.9850       7.4680       9.2932      11.4606      14.8828      15.4532      15.5473
                15.6814      15.7954      16.0236      16.2517      16.4799      16.7080      16.8221      16.7080
                16.5940      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     -0.00      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000       0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     -0.00      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     -0.00      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
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                             BALLISTIC COEFFICIENTS AND FORCE CENTERS

                                     NORMAL CENTER OF PRESSURE

MACH NOS.    .0100     .6000     .8000     .9000     .9500    1.0000    1.0500    1.1000
            1.2000    1.3500    1.5000    1.7500    2.0000    2.5000    3.0000    4.0000
            5.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
 ANGLES
   OF                          CENTERS OF PRESSURE (CALIPERS FROM NOSE)
 ATTACK
   0.00      .9417     .8896     .7363     .6952     .7337    1.1884    1.3503    1.4404
            1.5521    1.6847    1.8054    1.9588    2.0653    2.2092    2.2748    2.2504
            2.2150   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
  57.30      .9417     .8896     .7363     .6952     .7337    1.1884    1.3503    1.4404
            1.5521    1.6847    1.8054    1.9588    2.0653    2.2092    2.2748    2.2504
            2.2150   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
  -0.00    -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
  -0.00    -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
  -0.00    -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000

                                     MAGNUS FORCE COEFFICIENTS

MACH NOS.    .0100     .6000     .8000     .9000     .9500    1.0000    1.0500    1.1000
            1.2000    1.3500    1.5000    1.7500    2.0000    2.5000    3.0000    4.0000
            5.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
 ANGLES
   OF                                       COEFFICIENTS
 ATTACK
   0.00    -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
  57.30      .6610     .6610     .8262     .9915    1.1567    1.1014    1.0466     .9364
             .8042     .7271     .6389     .6169     .6169     .6169     .6169     .6169
             .6169   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
  -0.00    -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
  -0.00    -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
  -0.00    -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
           -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000   -0.0000
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                                    BALLISTIC COEFFICIENTS AND FORCE CENTERS

                                         SPIN DECELERATION COEFFICIENTS

   MACH NOS.     .0100        .6000        .8000        .9000        .9500       1.0000       1.0500       1.1000
                1.2000       1.3500       1.5000       1.7500       2.0000       2.5000       3.0000       4.0000
                5.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
   ANGLES
     OF                                                COEFFICIENTS
   ATTACK
     0.00        .0200        .0200        .0191        .0141        .0140        .0132        .0132        .0132
                 .0132        .0132        .0132        .0127        .0121        .0116        .0110        .0102
                 .0105      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
    57.30        .0200        .0200        .0191        .0141        .0140        .0132        .0132        .0132
                 .0132        .0132        .0132        .0127        .0121        .0116        .0110        .0102
                 .0105      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
    -0.00      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
               -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
               -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
    -0.00      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
               -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
               -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
    -0.00      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
               -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
               -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                                           MAGNUS CENTER OF PRESSURE
   MACH NOS.     .0100        .6000        .8000        .9000        .9500       1.0000       1.0500       1.1000
                1.2000       1.3500       1.5000       1.7500       2.0000       2.5000       3.0000       4.0000
                5.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
   ANGLES
     OF                              CENTERS OF PRESSURE (CALIBERS FROM NOSE)
   ATTACK
     0.00       2.8901       2.8901       3.0895       3.3884       3.4881       3.5878       3.6874       3.7871
                3.9366       4.0861       4.2854       4.4548       4.4548       4.4548       4.4548       4.4548
                4.4548      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     1.00       2.8901       2.8901       3.0895       3.3884       3.4881       3.5878       3.6874       3.7871
                3.9366       4.0861       4.2854       4.4548       4.4548       4.4548       4.4548       4.4548
                4.4548      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     2.00       3.2888       3.2888       3.4881       3.7871       3.8569       3.9366       4.0063       4.0661
                4.1458       4.2455       4.3352       4.5046       4.5046       4.5046       4.5046       4.5046
                4.5046      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
     5.00       4.0457       4.0457       4.1494       4.4606       4.5125       4.5644       4.5851       4.6059
                4.6266       4.6474       4.6889       4.6889       4.6889       4.6889       4.6889       4.6889
                4.6889      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
    57.30       4.0457       4.0457       4.1494       4.4606       4.5125       4.5644       4.5851       4.6059
                4.6266       4.6474       4.6889       4.6889       4.6889       4.6889       4.6889       4.6889
                4.6889      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000      -0.0000
                                     NO CALCULATIONS REQUIRED FOR PHASE 1
                                     NO CALCULATIONS REQUIRED FOR PHASE 2
                                     NO CALCULATIONS REQUIRED FOR PHASE 3
                                     NO CALCULATIONS REQUIRED FOR PHASE 4
                                     NO CALCULATIONS REQUIRED FOR PHASE 5
                                     NO CALCULATIONS REQUIRED FOR PHASE 6
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                         BALLISTIC COEFFICIENTS AND FORCE CENTERS

                                 AXIAL DRAG COEFFICIENTS

MACH NOS.     .0100      .6000      .8000      .9000      .9500     1.0000     1.0500     1.1000
             1.2000     1.3500     1.5000     1.7500     2.0000     2.5000     3.0000     4.0000
             5.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
  ANGLES
    OF                                   COEFFICIENTS
  ATTACK
   0.00       .1408      .1408      .1455      .1813      .2302      .3470      .3753      .3747
              .3645      .3435      .3284      .3044      .2792      .2447      .2171      .1797
              .1611    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
  57.30       .1408      .1408      .1455      .1813      .2302      .3470      .3753      .3747
              .3645      .3435      .3284      .3044      .2792      .2447      .2171      .1797
              .1611    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
  -0.00     -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
            -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
            -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
  -0.00     -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
            -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
            -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
  -0.00     -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
            -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
            -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000
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SIX-DEGREE OF FREEDOM MISSILE TRAJECTORY

PHASE SEVEN
FREE-FLIGHT OF MAIN STAGE

TIME	RANGE VX-EARTH ROLL-RATE	DEFLECTION VY-EARTH PITCH-RATE	ALTITUDE VZ-EARTH YAW-RATE	VX-MISSILE MASS PSI	VY-MISSILE THRUST THETA	VZ-MISSILE MACH NO. TOTAL DRAG	V-MISSILE TDRAG COEF ALPHA
0.0000	0.	0.	0.	975.100	0.000	0.000	975.1000
	.9543A392E+03	0.	.1902?1A1E+03	3.21377	0.000	.877	.172
	.4A361000E+03	0.	0.	0.000	348.750	39.291	.0000
1.0112	.?9?945?5E+03	-.61975972E-01	.53?99474E+02	957.363	-2.006	.416	957.3657
	.9446?425E+03	-.41710112E+00	.1554117AE+03	3.21377	0.000	.858	.166
	.5970?553E+03	-.34231A15E-01	.2747795AE-02	.096	350.670	36.474	.1226
2.0491	.589?5424E+03	-.25725646E+00	.9499488?E+02	941.111	-3.446	4.216	941.1264
	.9333A410E+03	-.88006098E+00	.1202?167E+03	3.21377	0.000	.844	.161
	.591330?0E-02	-.5024247?E-01	.52369656E-01	.157	352.993	34.043	.3315
3.0728	.9795?606F+03	-.57863104E+00	.1293?472E+03	926.856	5.000	12.093	926.9481
	.9238?567E+03	-.11692497E+01	.?667A?21E+02	3.21377	0.000	.831	.157
	.5?57?132E+03	.55123536F-01	.1404?382E+00	359.605	355.382	32.073	.?089
4.0808	.11?15?48E+04	-.10213955E+01	.150?547E+03	914.442	20.766	-4.038	914.6865
	.9131?650E+03	-.15948?24E+01	.5370?54?E+02	3.21377	0.000	.821	.154
	.5?A29697E+03	.2294?526E+00	-.54600138E-01	358.597	356.380	30.512	1.3253
5.0821	.14?8?269E+04	-.16014483E+01	.1622?034E+03	903.856	-12.012	-16.419	904.0889
	.9018?487E+03	-.19215046E+01	.?0827?90E+02	3.21377	0.000	.811	.150
	.57491679E+03	-.15596363E+00	-.1?400124E+00	.640	357.626	29.117	1.2996
6.0857	.17139493E+04	-.22916996E+01	.1637?077E+03	894.549	1.524	27.402	894.9697
	.89489496E+03	-.27727442E+01	-.11226400E+02	3.21377	0.000	.803	.148
	.5605?025E+03	.15719296E-01	.30940521E+00	359.725	2.473	28.110	1.7573
7.1101	.19910795E+04	-.31232?38E+01	.155096?6E+03	886.455	30.708	-16.984	887.1491
	.88?073?2E+03	-.?6726745E+01	-.4359540?E+02	3.21377	0.000	.796	.148
	.5?413722E+03	.33291A31E+00	-.197A3526E+00	357.841	1.721	27.414	?.?670
8.1121	.?2?12801E+04	-.40869?A9E+01	.1369?270E+03	880.272	-30.167	-1.475	880.7900
	.87751665E+03	-.33353A51E+01	-.?579?145E+02	3.21377	0.000	.790	.147
	.55?90521E+03	-.3526?932E+00	-.?24?2990E-02	1.752	4.843	27.121	1.9651
9.1341	.25?370?3E+04	-.515?8779E+01	.10?41432E+03	874.704	28.486	26.982	875.5836
	.?4900713E+03	-.394001A7E+01	-.10704052E+02	3.21377	0.000	.785	.149
	.55?67464E+03	.31855717E+00	.303?1302E+00	357.862	8.793	27.109	?.5684
9.3829	.25991187E+04	-.54607470E+01	.99974?36E+02	873.890	-32.259	-7.095	874.5141
	.?6?85?62E+03	-.37802373E+01	-.11544?03E+03	3.21377	0.000	.784	.148
	.55?36033E+03	-.38174507E+00	-.?703?14?E-01	1.883	7.126	26.982	?.1645

RANGE IN METERS = 2599.12 MAXIMUM ALTITUDE IN METERS = 164.29

END OF TRAJECTORY 1

SUMMARY OF PERTINENT DATA

DATE	NO.	TYPE	G.F.	MAX RANGE	MAX ALT	DEFLECTION	IMPACT VEL	TIME (M.A.)	TIME	THETA

[illegible] 1 [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

XM 827 SPINNER ALL DALE BOCX

SUMMARY OF PERTINENT DATA

DATE	NO.	TYPE	O.E.	MAX RANGE	MAX ALT	DEFLECTION	IMPACT VEL	TIME (M.S.)	TIME	THETA

Section K-10

MAX PRESS PF= 45000.0000 PSI FLEC WT.= 11.5700 LB-2 SABOT WT.= 4.3144 BORE FRICTION= 0.0000
EFFECT SEGMENTS= 4. OR MASS=0.000

SABOT WALL RAD= .2850 IN SABOT MIN RAD= .2500 IN SABOT LENGTH= .4600 IN SABOT REAR VOL = 0.0000 IN3 SABOT HEAD VOL = .013800 IN

SABOT DENSITY= 104.0000 LB-IN3 STOLT TYP= 0.0000 FLEC DIA= .2720 IN BORE DIA= .2775 IN SLOTS= 4 CYLINDER= 4 CF= 5.0000

BORE AREA= .0404 IN-2 -2465.881037	STRESS= 0.000000	-45000.0000 0.000000	AREA RATIO-2= .1002 IN 0.000000	X-SEC AREA= .0038 IN-2	FRICTION COEF= .0002	1
BORE AREA= .0404 IN-2 -2468.012643	STRESS= 4.510814	-4344.9.4128 -.000371	AREA RATIO-2= .1002 IN 4.508070	X-SEC AREA= .0038 IN-2	FRICTION COEF= .0002	2
BORE AREA= .0404 IN-2 -2450.155474	STRESS= 9.033336	-41075.8309 -.141911	AREA RATIO-2= .1002 IN 9.022245	X-SEC AREA= .0039 IN-2	FRICTION COEF= .0002	3
BORE AREA= .0404 IN-2 -2452.288095	STRESS= 13.567645	-40617.6884 -.244625	AREA RATIO-2= .1002 IN 13.542542	X-SEC AREA= .0039 IN-2	FRICTION COEF= .0002	4
BORE AREA= .0404 IN-2 -2454.415952	STRESS= 18.111388	-55004.3124 -.338514	AREA RATIO-2= .1002 IN 18.069864	X-SEC AREA= .0040 IN-2	FRICTION COEF= .0002	5
BORE AREA= .0404 IN-2 -2456.533772	STRESS= 22.672136	-57703.4781 -.413590	AREA RATIO-2= .1002 IN 22.601157	X-SEC AREA= .0041 IN-2	FRICTION COEF= .0002	6
BORE AREA= .0404 IN-2 -2458.646188	STRESS= 27.242681	-54345.4322 -.499850	AREA RATIO-2= .1002 IN 27.134047	X-SEC AREA= .0041 IN-2	FRICTION COEF= .0002	7
BORE AREA= .0404 IN-2 -2460.741705	STRESS= 31.835077	-55017.8336 -.587200	AREA RATIO-2= .1002 IN 31.683668	X-SEC AREA= .0042 IN-2	FRICTION COEF= .0002	8
BORE AREA= .0404 IN-2 -2462.832670	STRESS= 36.419909	-53720.0526 -.675963	AREA RATIO-2= .1002 IN 36.233546	X-SEC AREA= .0042 IN-2	FRICTION COEF= .0002	9
BORE AREA= .0404 IN-2 -2464.916703	STRESS= 41.007202	-52451.0449 -.765784	AREA RATIO-2= .1002 IN 40.786385	X-SEC AREA= .0043 IN-2	FRICTION COEF= .0002	10
BORE AREA= .0404 IN-2 -2466.987710	STRESS= 45.647838	-51203.5009 -.866830	AREA RATIO-2= .1002 IN 45.350972	X-SEC AREA= .0043 IN-2	FRICTION COEF= .0002	11
BORE AREA= .0404 IN-2 -2469.051477	STRESS= 50.279469	-49995.4577 -.949082	AREA RATIO-2= .1002 IN 49.918280	X-SEC AREA= .0044 IN-2	FRICTION COEF= .0002	12
BORE AREA= .0404 IN-2 -2471.104470	STRESS= 54.934703	-48807.9351 -1.042543	AREA RATIO-2= .1002 IN 54.491246	X-SEC AREA= .0045 IN-2	FRICTION COEF= .0002	13
BORE AREA= .0404 IN-2 -2473.152035	STRESS= 59.582781	-47644.3680 -1.137220	AREA RATIO-2= .1002 IN 59.060085	X-SEC AREA= .0045 IN-2	FRICTION COEF= .0002	14
BORE AREA= .0404 IN-2 -2475.198299	STRESS= 64.253836	-46505.6745 -1.233115	AREA RATIO-2= .1002 IN 63.654451	X-SEC AREA= .0046 IN-2	FRICTION COEF= .0002	15
BORE AREA= .0404 IN-2 -2477.215188	STRESS= 68.937985	-45390.5753 -1.330234	AREA RATIO-2= .1002 IN 68.269379	X-SEC AREA= .0046 IN-2	FRICTION COEF= .0002	16
BORE AREA= .0404 IN-2 -2479.232428	STRESS= 73.636346	-44298.2217 -1.428579	AREA RATIO-2= .1002 IN 72.893684	X-SEC AREA= .0047 IN-2	FRICTION COEF= .0002	17
BORE AREA= .0404 IN-2 -2481.240545	STRESS= 78.344877	-43228.2039 -1.528154	AREA RATIO-2= .1002 IN 77.532766	X-SEC AREA= .0047 IN-2	FRICTION COEF= .0002	18
BORE AREA= .0404 IN-2 -2483.238846	STRESS= 83.070181	-42179.5389 -1.628947	AREA RATIO-2= .1002 IN 82.185994	X-SEC AREA= .0048 IN-2	FRICTION COEF= .0002	19
BORE AREA= .0404 IN-2 -2485.227516	STRESS= 87.807899	-41151.4717 -1.731014	AREA RATIO-2= .1002 IN 86.852566	X-SEC AREA= .0049 IN-2	FRICTION COEF= .0002	20
BORE AREA= .0404 IN-2 -2487.206423	STRESS= 92.559317	-40141.9737 -1.834313	AREA RATIO-2= .1002 IN 91.534154	X-SEC AREA= .0049 IN-2	FRICTION COEF= .0002	21
BORE AREA= .0404 IN-2 -2489.175511	STRESS= 97.324540	-39150.8411 -1.938855	AREA RATIO-2= .1002 IN 96.230330	X-SEC AREA= .0050 IN-2	FRICTION COEF= .0002	22
BORE AREA= .0404 IN-2 -2491.134744	STRESS= 102.103767	-38178.6440 -2.044648	AREA RATIO-2= .1002 IN 100.941613	X-SEC AREA= .0050 IN-2	FRICTION COEF= .0002	23
BORE AREA= .0404 IN-2	STRESS=	-37225.[illegible]	AREA RATIO-2= .1002 IN	X-SEC AREA= .0051 IN-2	FRICTION COEF= .0002	24
BORE AREA= .0404 IN-2	STRESS=	-36291.[illegible]	AREA RATIO-2= .1002 IN	X-SEC AREA= .0052 IN-2	FRICTION COEF= .0002	25

BORE AREA= .0404 IN-2 STRESS= -35987.6443	AREA RATIO-2= .1002 IN	X-SEC AREA= .0052 IN-2	FRICTION COEF= .0082	26
-296.952212 116.526381 -2.369580 114.434717				
BORE AREA= .0404 IN-2 STRESS= -34489.1315	AREA RATIO-2= .1002 IN	X-SEC AREA= .0053 IN-2	FRICTION COEF= .0082	27
-298.871104 121.362712 -2.480421 119.084477				
BORE AREA= .0404 IN-2 STRESS= -33606.9680	AREA RATIO-2= .1002 IN	X-SEC AREA= .0053 IN-2	FRICTION COEF= .0082	28
-300.779736 126.213665 -2.592534 123.734443				
BORE AREA= .0404 IN-2 STRESS= -32748.7495	AREA RATIO-2= .1002 IN	X-SEC AREA= .0054 IN-2	FRICTION COEF= .0082	29
-302.678034 131.079380 -2.705924 128.394568				
BORE AREA= .0404 IN-2 STRESS= -31898.0336	AREA RATIO-2= .1002 IN	X-SEC AREA= .0055 IN-2	FRICTION COEF= .0082	30
-304.565924 135.959908 -2.820593 133.057208				
BORE AREA= .0404 IN-2 STRESS= -31054.3940	AREA RATIO-2= .1002 IN	X-SEC AREA= .0055 IN-2	FRICTION COEF= .0082	31
-306.443331 140.855663 -2.936547 137.724719				
BORE AREA= .0404 IN-2 STRESS= -30233.4198	AREA RATIO-2= .1002 IN	X-SEC AREA= .0056 IN-2	FRICTION COEF= .0082	32
-308.310183 145.766520 -3.053790 142.397055				
BORE AREA= .0404 IN-2 STRESS= -29426.7151	AREA RATIO-2= .1002 IN	X-SEC AREA= .0057 IN-2	FRICTION COEF= .0082	33
-310.166406 150.692716 -3.172325 147.074172				
BORE AREA= .0404 IN-2 STRESS= -28633.8977	AREA RATIO-2= .1002 IN	X-SEC AREA= .0057 IN-2	FRICTION COEF= .0082	34
-312.011925 155.634482 -3.292157 151.756624				
BORE AREA= .0404 IN-2 STRESS= -27854.5992	AREA RATIO-2= .1002 IN	X-SEC AREA= .0058 IN-2	FRICTION COEF= .0082	35
-313.846667 160.591729 -3.413290 156.442568				
BORE AREA= .0404 IN-2 STRESS= -27088.4639	AREA RATIO-2= .1002 IN	X-SEC AREA= .0058 IN-2	FRICTION COEF= .0082	36
-315.670559 165.564851 -3.535728 161.133757				
BORE AREA= .0404 IN-2 STRESS= -26335.1484	AREA RATIO-2= .1002 IN	X-SEC AREA= .0059 IN-2	FRICTION COEF= .0082	37
-317.483526 170.553924 -3.659475 165.829548				
BORE AREA= .0404 IN-2 STRESS= -25594.3212	AREA RATIO-2= .1002 IN	X-SEC AREA= .0060 IN-2	FRICTION COEF= .0082	38
-319.285494 175.559186 -3.784534 170.529896				
BORE AREA= .0404 IN-2 STRESS= -24865.6621	AREA RATIO-2= .1002 IN	X-SEC AREA= .0060 IN-2	FRICTION COEF= .0082	39
-321.076391 180.580558 -3.910912 175.234755				
BORE AREA= .0404 IN-2 STRESS= -24148.8615	AREA RATIO-2= .1002 IN	X-SEC AREA= .0061 IN-2	FRICTION COEF= .0082	40
-322.856141 185.618462 -4.038610 179.944088				
BORE AREA= .0404 IN-2 STRESS= -23443.6205	AREA RATIO-2= .1002 IN	X-SEC AREA= .0061 IN-2	FRICTION COEF= .0082	41
-324.624672 190.672924 -4.167634 184.657828				
BORE AREA= .0404 IN-2 STRESS= -22749.6497	AREA RATIO-2= .1002 IN	X-SEC AREA= .0062 IN-2	FRICTION COEF= .0082	42
-326.381909 195.744171 -4.297987 189.375953				
BORE AREA= .0404 IN-2 STRESS= -22066.6697	AREA RATIO-2= .1002 IN	X-SEC AREA= .0063 IN-2	FRICTION COEF= .0082	43
-328.127779 200.832353 -4.429674 194.098410				
BORE AREA= .0404 IN-2 STRESS= -21394.4100	AREA RATIO-2= .1002 IN	X-SEC AREA= .0063 IN-2	FRICTION COEF= .0082	44
-329.862207 205.937642 -4.562699 198.825155				
BORE AREA= .0404 IN-2 STRESS= -20732.6087	AREA RATIO-2= .1002 IN	X-SEC AREA= .0064 IN-2	FRICTION COEF= .0082	45
-331.585121 211.060213 -4.697065 203.556142				
BORE AREA= .0404 IN-2 STRESS= -20081.0126	AREA RATIO-2= .1002 IN	X-SEC AREA= .0065 IN-2	FRICTION COEF= .0082	46
-333.296447 216.200243 -4.832778 208.291128				
BORE AREA= .0404 IN-2 STRESS= -19439.3764	AREA RATIO-2= .1002 IN	X-SEC AREA= .0065 IN-2	FRICTION COEF= .0082	47
-334.996109 221.357912 -4.969840 213.030666				
BORE AREA= .0404 IN-2 STRESS= -18807.4627	AREA RATIO-2= .1002 IN	X-SEC AREA= .0066 IN-2	FRICTION COEF= .0082	48
-336.684036 226.533402 -5.108257 217.774112				
BORE AREA= .0404 IN-2 STRESS= -18185.0415	AREA RATIO-2= .1002 IN	X-SEC AREA= .0067 IN-2	FRICTION COEF= .0082	49
-338.360153 231.726898 -5.246831 222.521421				
BORE AREA= .0404 IN-2 STRESS= -17571.8898	AREA RATIO-2= .1002 IN	X-SEC AREA= .0067 IN-2	FRICTION COEF= .0082	50
-340.024305 236.938587 -5.389168 227.279149				

BORE AREA= .0404 IN-2 STRESS= -16967.7918		AREA RATIO-2= .1002 IN		X-SEC AREA= .0068 IN-2		FRICTION COEF= .0882	51			
-341.676661	242.168659	-5.531672	232.029651							
BORE AREA= .0404 IN-2 STRESS= -16372.5380		AREA RATIO-2= .1002 IN		X-SEC AREA= .0069 IN-2		FRICTION COEF= .0882	52			
-343.316905	247.417308	-5.675546	236.788082							
BORE AREA= .0404 IN-2 STRESS= -15785.9256		AREA RATIO-2= .1002 IN		X-SEC AREA= .0069 IN-2		FRICTION COEF= .0882	53			
-344.945843	252.664738	-5.820794	241.551396							
BORE AREA= .0404 IN-2 STRESS= -15207.7576		AREA RATIO-2= .1002 IN		X-SEC AREA= .0070 IN-2		FRICTION COEF= .0882	54			
-346.561003	257.971121	-5.967422	246.318550							
BORE AREA= .0404 IN-2 STRESS= -14637.8431		AREA RATIO-2= .1002 IN		X-SEC AREA= .0070 IN-2		FRICTION COEF= .0882	55			
-348.164710	263.276685	-6.115432	251.089497							
BORE AREA= .0404 IN-2 STRESS= -14075.9970		AREA RATIO-2= .1002 IN		X-SEC AREA= .0071 IN-2		FRICTION COEF= .0882	56			
-349.756091	268.681625	-6.264829	255.864195							
BORE AREA= .0404 IN-2 STRESS= -13522.0303		AREA RATIO-2= .1002 IN		X-SEC AREA= .0072 IN-2		FRICTION COEF= .0882	57			
-351.335071	273.946148	-6.415617	260.649597							
BORE AREA= .0404 IN-2 STRESS= -12975.7956		AREA RATIO-2= .1002 IN		X-SEC AREA= .0072 IN-2		FRICTION COEF= .0882	58			
-352.901577	279.310665	-6.567800	265.424659							
BORE AREA= .0404 IN-2 STRESS= -12437.0965		AREA RATIO-2= .1002 IN		X-SEC AREA= .0073 IN-2		FRICTION COEF= .0882	59			
-354.455536	284.694788	-6.721383	270.210335							
BORE AREA= .0404 IN-2 STRESS= -11905.7775		AREA RATIO-2= .1002 IN		X-SEC AREA= .0074 IN-2		FRICTION COEF= .0882	60			
-355.996873	290.099335	-6.876368	276.990582							
BORE AREA= .0404 IN-2 STRESS= -11381.6788		AREA RATIO-2= .1002 IN		X-SEC AREA= .0074 IN-2		FRICTION COEF= .0882	61			
-357.525514	295.524324	-7.032761	279.792355							
BORE AREA= .0404 IN-2 STRESS= -10864.6450		AREA RATIO-2= .1002 IN		X-SEC AREA= .0075 IN-2		FRICTION COEF= .0882	62			
-359.041386	300.969977	-7.190566	284.588607							
BORE AREA= .0404 IN-2 STRESS= -10354.5254		AREA RATIO-2= .1002 IN		X-SEC AREA= .0076 IN-2		FRICTION COEF= .0882	63			
-360.544416	306.436522	-7.349786	289.388296							
BORE AREA= .0404 IN-2 STRESS= -9851.1734		AREA RATIO-2= .1002 IN		X-SEC AREA= .0076 IN-2		FRICTION COEF= .0882	64			
-362.034528	311.924187	-7.510626	294.191375							
BORE AREA= .0404 IN-2 STRESS= -9354.4464		AREA RATIO-2= .1002 IN		X-SEC AREA= .0077 IN-2		FRICTION COEF= .0882	65			
-363.511650	317.433284	-7.672490	298.997800							
BORE AREA= .0404 IN-2 STRESS= -8866.2658		AREA RATIO-2= .1002 IN		X-SEC AREA= .0078 IN-2		FRICTION COEF= .0882	66			
-364.975708	322.963889	-7.835982	303.807526							
BORE AREA= .0404 IN-2 STRESS= -8390.3170		AREA RATIO-2= .1002 IN		X-SEC AREA= .0079 IN-2		FRICTION COEF= .0882	67			
-366.426627	328.516242	-8.000905	308.620509							
BORE AREA= .0404 IN-2 STRESS= -7902.6488		AREA RATIO-2= .1002 IN		X-SEC AREA= .0079 IN-2		FRICTION COEF= .0882	68			
-367.864335	334.098746	-8.167265	313.436703							
BORE AREA= .0404 IN-2 STRESS= -7431.0738		AREA RATIO-2= .1002 IN		X-SEC AREA= .0080 IN-2		FRICTION COEF= .0882	69			
-369.288757	339.687566	-8.335065	318.256464							
BORE AREA= .0404 IN-2 STRESS= -6965.4678		AREA RATIO-2= .1002 IN		X-SEC AREA= .0081 IN-2		FRICTION COEF= .0882	70			
-370.699819	345.306954	-8.504310	323.078546							
BORE AREA= .0404 IN-2 STRESS= -6505.7102		AREA RATIO-2= .1002 IN		X-SEC AREA= .0081 IN-2		FRICTION COEF= .0882	71			
-372.097449	350.969162	-8.675002	327.904106							
BORE AREA= .0404 IN-2 STRESS= -6051.6833		AREA RATIO-2= .1002 IN		X-SEC AREA= .0082 IN-2		FRICTION COEF= .0882	72			
-373.481571	356.614449	-8.847148	332.732498							
BORE AREA= .0404 IN-2 STRESS= -5603.2728		AREA RATIO-2= .1002 IN		X-SEC AREA= .0083 IN-2		FRICTION COEF= .0882	73			
-374.852112	362.363875	-9.020750	337.564277							
BORE AREA= .0404 IN-2 STRESS= -5160.3673		AREA RATIO-2= .1002 IN		X-SEC AREA= .0083 IN-2		FRICTION COEF= .0882	74			
-376.208999	368.015387	-9.195812	342.398798							
BORE AREA= .0404 IN-2 STRESS= -4722.8582		AREA RATIO-2= .1002 IN		X-SEC AREA= .0084 IN-2		FRICTION COEF= .0882	75			
-377.552158	373.751412	-9.372340	347.236217							

BORE AREA= .0404 IN-2 STRESS= -4240.6198 AREA RATIO-2= .1002 IN X-SEC AREA= .0085 IN-2 FRICTION COEF= .0882 76									
-378.881514	379.511664	-9.550336	362.074489						
BORE AREA= .0404 IN-2 STRESS= -3863.6093 AREA RATIO-2= .1002 IN X-SEC AREA= .0085 IN-2 FRICTION COEF= .0882 77									
-380.196994	385.296341	-9.729805	366.919569						
BORE AREA= .0404 IN-2 STRESS= -3441.6662 AREA RATIO-2= .1002 IN X-SEC AREA= .0086 IN-2 FRICTION COEF= .0882 78									
-381.498525	391.105724	-9.910752	361.765412						
BORE AREA= .0404 IN-2 STRESS= -3024.7128 AREA RATIO-2= .1002 IN X-SEC AREA= .0087 IN-2 FRICTION COEF= .0882 79									
-382.786832	396.940899	-10.093179	366.613974						
BORE AREA= .0404 IN-2 STRESS= -2612.6537 AREA RATIO-2= .1002 IN X-SEC AREA= .0088 IN-2 FRICTION COEF= .0882 80									
-384.059442	402.799755	-10.277092	371.465209						
BORE AREA= .0404 IN-2 STRESS= -2205.3961 AREA RATIO-2= .1002 IN X-SEC AREA= .0088 IN-2 FRICTION COEF= .0882 81									
-385.318688	408.684988	-10.462495	376.319872						
BORE AREA= .0404 IN-2 STRESS= -1802.8494 AREA RATIO-2= .1002 IN X-SEC AREA= .0089 IN-2 FRICTION COEF= .0882 82									
-386.563674	414.596095	-10.640398	381.175520						
BORE AREA= .0404 IN-2 STRESS= -1404.9252 AREA RATIO-2= .1002 IN X-SEC AREA= .0090 IN-2 FRICTION COEF= .0882 83									
-387.794349	420.533380	-10.817784	386.034586						
BORE AREA= .0404 IN-2 STRESS= -1011.5374 AREA RATIO-2= .1002 IN X-SEC AREA= .0090 IN-2 FRICTION COEF= .0882 84									
-389.018632	426.497152	-11.027679	390.895987						
BORE AREA= .0404 IN-2 STRESS= -622.6019 AREA RATIO-2= .1002 IN X-SEC AREA= .0091 IN-2 FRICTION COEF= .0882 85									
-390.212449	432.487723	-11.219080	395.759917						
BORE AREA= .0404 IN-2 STRESS= -238.0368 AREA RATIO-2= .1002 IN X-SEC AREA= .0092 IN-2 FRICTION COEF= .0882 86									
-391.399725	438.505411	-11.411991	400.624251						
BORE AREA= .0404 IN-2 STRESS= 142.2381 AREA RATIO-2= .1002 IN X-SEC AREA= .0093 IN-2 FRICTION COEF= .0882 87									
-392.572388	444.558517	-11.606416	405.494945						
BORE AREA= .0404 IN-2 STRESS= 518.3008 AREA RATIO-2= .1002 IN X-SEC AREA= .0093 IN-2 FRICTION COEF= .0882 88									
-393.738363	450.623430	-11.802359	410.365954						
BORE AREA= .0404 IN-2 STRESS= 898.2274 AREA RATIO-2= .1002 IN X-SEC AREA= .0094 IN-2 FRICTION COEF= .0882 89									
-394.873577	456.724422	-11.999824	415.239233						
BORE AREA= .0404 IN-2 STRESS= 1258.0925 AREA RATIO-2= .1002 IN X-SEC AREA= .0095 IN-2 FRICTION COEF= .0882 90									
-396.001956	462.853851	-12.198816	420.114737						
BORE AREA= .0404 IN-2 STRESS= 1621.9686 AREA RATIO-2= .1002 IN X-SEC AREA= .0095 IN-2 FRICTION COEF= .0882 91									
-397.115426	469.012058	-12.399338	424.992421						
BORE AREA= .0404 IN-2 STRESS= 1981.9267 AREA RATIO-2= .1002 IN X-SEC AREA= .0096 IN-2 FRICTION COEF= .0882 92									
-398.213913	475.199393	-12.601394	429.872241						
BORE AREA= .0404 IN-2 STRESS= 2338.0361 AREA RATIO-2= .1002 IN X-SEC AREA= .0097 IN-2 FRICTION COEF= .0882 93									
-399.297343	481.416209	-12.804989	434.754151						
BORE AREA= .0404 IN-2 STRESS= 2690.3444 AREA RATIO-2= .1002 IN X-SEC AREA= .0098 IN-2 FRICTION COEF= .0882 94									
-400.365644	487.662865	-13.010127	439.638187						
BORE AREA= .0404 IN-2 STRESS= 3038.9777 AREA RATIO-2= .1002 IN X-SEC AREA= .0098 IN-2 FRICTION COEF= .0882 95									
-401.418748	493.939727	-13.216812	444.524865						
BORE AREA= .0404 IN-2 STRESS= 3383.9407 AREA RATIO-2= .1002 IN X-SEC AREA= .0099 IN-2 FRICTION COEF= .0882 96									
-402.456559	500.247164	-13.425047	449.411978						
BORE AREA= .0404 IN-2 STRESS= 3725.3143 AREA RATIO-2= .1002 IN X-SEC AREA= .0100 IN-2 FRICTION COEF= .0882 97									
-403.479025	506.585553	-13.634838	454.301803						
BORE AREA= .0404 IN-2 STRESS= 4063.1464 AREA RATIO-2= .1002 IN X-SEC AREA= .0101 IN-2 FRICTION COEF= .0882 98									
-404.486867	512.955277	-13.846187	459.193494						
BORE AREA= .0404 IN-2 STRESS= 4397.5511 AREA RATIO-2= .1002 IN X-SEC AREA= .0101 IN-2 FRICTION COEF= .0882 99									
-405.477609	519.356724	-14.059100	464.087007						
BORE AREA= .0404 IN-2 STRESS= 4728.5293 AREA RATIO-2= .1002 IN X-SEC AREA= .0102 IN-2 FRICTION COEF= .0882 100									
-406.453578	525.798289	-14.273580	468.982297						

BORE AREA= .0404 IN-2 STRESS=	5056.1588	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0103 IN-2	FRICTION COEF=	.0882	101		
-407.413901	532.256373	-14.489632	473.879319							
BORE AREA= .0404 IN-2 STRESS=	5180.4958	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0104 IN-2	FRICTION COEF=	.0882	102		
-408.358503	538.755384	-14.767259	478.778428							
BORE AREA= .0404 IN-2 STRESS=	5301.5054	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0104 IN-2	FRICTION COEF=	.0882	103		
-409.287311	545.287715	-14.924465	483.678379							
BORE AREA= .0404 IN-2 STRESS=	6419.5114	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0105 IN-2	FRICTION COEF=	.0882	104		
-410.200250	551.853848	-15.147256	488.580328							
BORE AREA= .0404 IN-2 STRESS=	6334.2966	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0106 IN-2	FRICTION COEF=	.0882	105		
-411.097248	558.454149	-15.369634	493.482829							
BORE AREA= .0404 IN-2 STRESS=	6646.0025	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0107 IN-2	FRICTION COEF=	.0882	106		
-411.978238	565.049075	-15.593604	498.388838							
BORE AREA= .0404 IN-2 STRESS=	6954.6795	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0107 IN-2	FRICTION COEF=	.0882	107		
-412.843122	571.759066	-15.819170	503.295311							
BORE AREA= .0404 IN-2 STRESS=	7260.3770	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0108 IN-2	FRICTION COEF=	.0882	108		
-413.691852	578.464571	-16.046336	508.203201							
BORE AREA= .0404 IN-2 STRESS=	7563.1432	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0109 IN-2	FRICTION COEF=	.0882	109		
-414.526344	585.286048	-16.275107	513.112465							
BORE AREA= .0404 IN-2 STRESS=	7863.0255	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0110 IN-2	FRICTION COEF=	.0882	110		
-415.340525	591.983959	-16.505485	518.023057							
BORE AREA= .0404 IN-2 STRESS=	8160.0700	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0110 IN-2	FRICTION COEF=	.0882	111		
-416.140322	598.798777	-16.737476	522.934933							
BORE AREA= .0404 IN-2 STRESS=	8454.3220	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0111 IN-2	FRICTION COEF=	.0882	112		
-416.923661	605.650981	-16.971084	527.848048							
BORE AREA= .0404 IN-2 STRESS=	8745.8260	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0112 IN-2	FRICTION COEF=	.0882	113		
-417.690467	612.541058	-17.206312	532.762957							
BORE AREA= .0404 IN-2 STRESS=	9034.6252	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0113 IN-2	FRICTION COEF=	.0882	114		
-418.440667	619.469505	-17.443165	537.677815							
BORE AREA= .0404 IN-2 STRESS=	9320.7622	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0113 IN-2	FRICTION COEF=	.0882	115		
-419.174188	626.436825	-17.681647	542.596377							
BORE AREA= .0404 IN-2 STRESS=	9604.2787	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0114 IN-2	FRICTION COEF=	.0882	116		
-419.890955	633.443532	-17.921761	547.511999							
BORE AREA= .0404 IN-2 STRESS=	9885.2154	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0115 IN-2	FRICTION COEF=	.0882	117		
-420.590895	640.490145	-18.163513	552.430635							
BORE AREA= .0404 IN-2 STRESS=	10163.6121	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0116 IN-2	FRICTION COEF=	.0882	118		
-421.273934	647.577196	-18.406906	557.350241							
BORE AREA= .0404 IN-2 STRESS=	10439.5082	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0117 IN-2	FRICTION COEF=	.0882	119		
-421.939998	654.745293	-18.651944	562.270773							
BORE AREA= .0404 IN-2 STRESS=	10712.9419	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0117 IN-2	FRICTION COEF=	.0882	120		
-422.589813	661.874776	-18.898631	567.192184							
BORE AREA= .0404 IN-2 STRESS=	10983.9507	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0118 IN-2	FRICTION COEF=	.0882	121		
-423.220986	669.006411	-19.146971	572.114431							
BORE AREA= .0404 IN-2 STRESS=	11252.5715	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0119 IN-2	FRICTION COEF=	.0882	122		
-423.835603	676.340697	-19.394970	577.037468							
BORE AREA= .0404 IN-2 STRESS=	11518.8404	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0120 IN-2	FRICTION COEF=	.0882	123		
-424.433029	683.638212	-19.642629	581.961251							
BORE AREA= .0404 IN-2 STRESS=	11782.7927	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0120 IN-2	FRICTION COEF=	.0882	124		
-425.013112	690.979541	-19.901955	586.886735							
BORE AREA= .0404 IN-2 STRESS=	12044.4631	AREA RATIO-2=	.1002 IN	X-SEC AREA=	.0121 IN-2	FRICTION COEF=	.0882	125		
-425.575777	698.365284	-20.156950	591.810875							

BORE AREA= .0404 IN-2 STRESS= 12303.8856 AREA RATIO-2= .1002 IN X-SEC AREA= .0122 IN-2 FRICTION COEF= .0882 126									
-426.128951	705.796049	-20.417619	596.734626						
BORE AREA= .0404 IN-2 STRESS= 12561.0935 AREA RATIO-2= .1002 IN X-SEC AREA= .0123 IN-2 FRICTION COEF= .0882 127									
-426.644560	713.272455	-20.671966	601.662944						
BORE AREA= .0404 IN-2 STRESS= 12816.1194 AREA RATIO-2= .1002 IN X-SEC AREA= .0124 IN-2 FRICTION COEF= .0882 128									
-427.158530	720.795131	-20.931996	606.589782						
BORE AREA= .0404 IN-2 STRESS= 13068.9954 AREA RATIO-2= .1002 IN X-SEC AREA= .0124 IN-2 FRICTION COEF= .0882 129									
-427.658787	728.344719	-21.197711	611.517698						
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-428.125258	735.981871	-21.457117	616.446845						
BORE AREA= .0404 IN-2 STRESS= 13568.4228 AREA RATIO-2= .1002 IN X-SEC AREA= .0126 IN-2 FRICTION COEF= .0882 131									
-428.581860	743.647253	-21.722217	621.372980						
BORE AREA= .0404 IN-2 STRESS= 13815.0352 AREA RATIO-2= .1002 IN X-SEC AREA= .0127 IN-2 FRICTION COEF= .0882 132									
-429.020545	751.361540	-21.980016	626.301457						
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-429.441213	759.125428	-22.257517	631.238230						
BORE AREA= .0404 IN-2 STRESS= 14302.2058 AREA RATIO-2= .1002 IN X-SEC AREA= .0129 IN-2 FRICTION COEF= .0882 134									
-429.843800	766.939596	-22.527725	636.159257						
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-430.942334	790.691096	-23.348630	650.947403						
BORE AREA= .0404 IN-2 STRESS= 15253.1255 AREA RATIO-2= .1002 IN X-SEC AREA= .0132 IN-2 FRICTION COEF= .0882 138									
-431.271856	798.713722	-23.625706	655.874491						
BORE AREA= .0404 IN-2 STRESS= 15486.1356 AREA RATIO-2= .1002 IN X-SEC AREA= .0133 IN-2 FRICTION COEF= .0882 139									
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BORE AREA= .0404 IN-2 STRESS= 15946.6758 AREA RATIO-2= .1002 IN X-SEC AREA= .0134 IN-2 FRICTION COEF= .0882 141									
-432.149426	823.108732	-24.467313	670.665747						
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-432.641236	839.652691	-25.037075	680.524461						
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-432.858948	848.011338	-25.324575	685.453647						
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-433.057768	856.428904	-25.617827	690.382792						
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-433.237620	864.906265	-25.904836	695.318952						
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-433.398432	873.444312	-26.197604	700.239181						
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-433.540129	882.043965	-26.492136	705.167035						
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-433.765884	899.431758	-27.086509	715.021439						

BORE AREA= .0404	IN-2	STRESS=	18146.0884	AREA RATIO-2=	.1002	IN	X-SEC AREA=	.0143	IN-2	FRICTION COEF=	.0082	151			
-433.849795	908.221828		-27.388358	719.947899											
BORE AREA= .0404	IN-2	STRESS=	18157.1050	AREA RATIO-2=	.1002	IN	X-SEC AREA=	.0143	IN-2	FRICTION COEF=	.0082	152			
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BORE AREA= .0404	IN-2	STRESS=	19389.5319	AREA RATIO-2=	.1002	IN	X-SEC AREA=	.0148	IN-2	FRICTION COEF=	.0082	157			
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-432.244379	1068.545166		-32.759556	803.574297											
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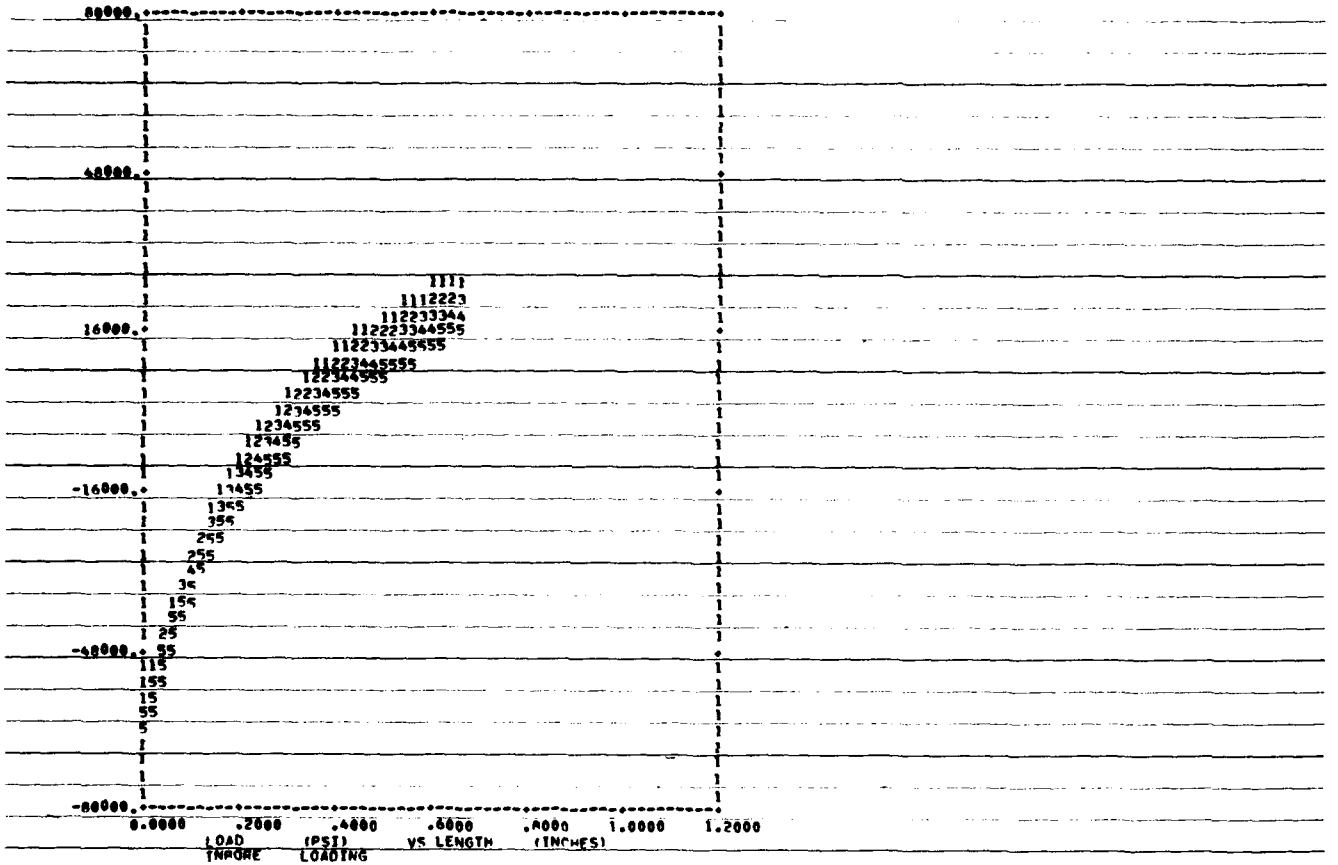
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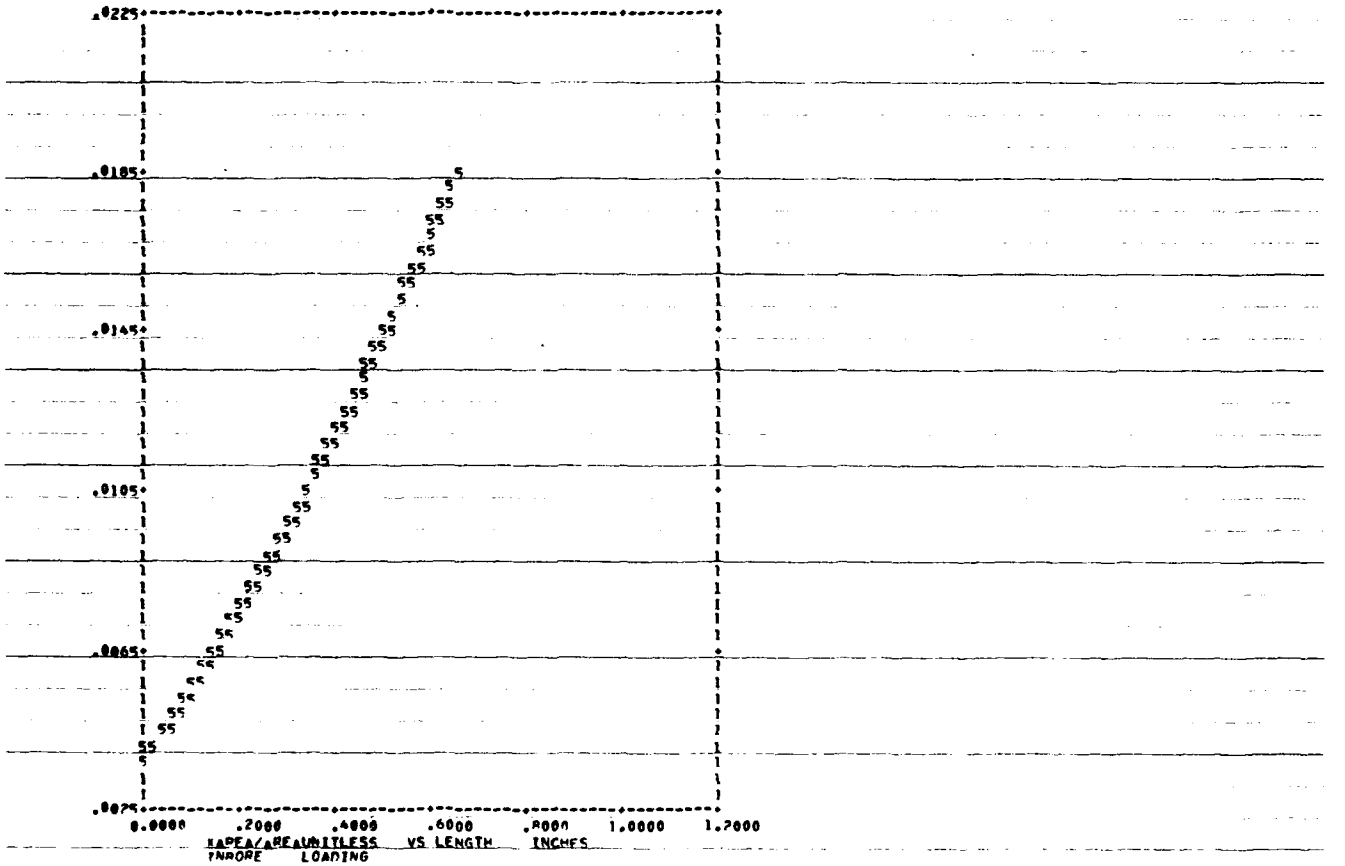
INCORE LOADING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AREA/AREA UNITLESS VS LENGTH INCHES
INPORE LOADING

Section K-11

EXPERIMENT IM

1

1

59400.0 4888.0 1.0 1.0

395.000 13.810 2350.00 180.000 12.800 1.23502000.0000.0000000.000000 1.000

117.10000 1.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000

PROGRAM NUMBER 2.00

INTERIOR BALLISTICS

MULTI-GRANULATION

WRITTEN AUGUST 1970 FOR IBM 360 SYSTEM

MATERIEL TESTING DIRECTORATE
ABERDEEN PROVING GROUNDS, MARYLAND

(CONVERTED TO CDC 6500
PICATINNY ARSENAL, DOVER, NJ
SID OPPASTEIN, EXTENSION 2367
MARCH 10, 1973)

INTERIOR BALLISTICS

EXPERIMENT TH

RUN NUMBER 1 BASIC RUN

BEAR PRESSURE, PSI	= 59400.0
MUZZLE VELOCITY, FPS	= 4850.0
NUMBER OF RUNS	= 1
NUMBER OF LINES BETWEEN TYPEOUT	= 1
CHAMBER VOLUME, CU IN.	= 795.000
CROSS SECTION OF BORE, SQ IN.	= 13.910
WEIGHT OF GUN AND RECOILING PTS, LB	= 2350.00
DISTANCE TRAVEL ALONG TUBE, IN.	= 188.000
PROJECTILE WEIGHT, LB	= 12.000
SPECIFIC ENERGY DATA	= 1.336
INITIAL PRESSURE, PSI	= 2000.00
ADJUSTMENT FACTOR FOR C	= 0.000
ADJUSTMENT FACTOR FOR B	= 0.000
PRESSURE FACTOR	= 1.000

PROPELLANT DATA

TYPE	NAME	WT,LB	WEB,IN.
1	7-PERF, CYL	12.10000	1.00000

COMPUTED Q AND B .076530 .735197

TOTAL LOADING DENSITY FOR ALL CHARGES= .067919

TIME SEC	PROPORTION OF PROPELLANT BURNED G71	G72	G73	G74	PROJECTILE TRAVEL INCHES	PROJECTILE VELOCITY FPS	CHAMBER PRESSURE PSI	PROJECTILE BASE PRESSURE PSI	PRESSURE RATIO PS/PC	PROJECTILE ACCELERATION G
0.000000	.0000	0.0000	0.0000	0.0000	0.00	0.00	2000.	1994.	.997000	2142.
.000012	.0094	0.0000	0.0000	0.0000	.01	10.79	3472.	3457.	.995556	3730.
.000024	.0150	0.0000	0.0000	0.0000	.03	28.61	5544.	5501.	.992306	5935.
.000036	.0224	0.0000	0.0000	0.0000	.09	55.99	8300.	8213.	.989045	8861.
.000048	.0339	0.0000	0.0000	0.0000	.20	95.75	11838.	11687.	.987207	12577.
.000060	.0445	0.0000	0.0000	0.0000	.38	150.90	16149.	15936.	.986940	17085.
.000072	.0598	0.0000	0.0000	0.0000	.65	224.39	21289.	20705.	.972564	22748.
.000085	.0775	0.0000	0.0000	0.0000	1.05	318.74	27067.	26110.	.964665	28171.
.000097	.0987	0.0000	0.0000	0.0000	1.60	435.64	33244.	31783.	.956042	34981.
.000110	.1231	0.0000	0.0000	0.0000	2.34	575.58	39536.	37761.	.955401	40110.
.000123	.1507	0.0000	0.0000	0.0000	3.31	737.31	45455.	42434.	.933553	45782.
.000136	.1811	0.0000	0.0000	0.0000	4.55	918.03	50609.	46419.	.917115	50297.
.000149	.2141	0.0000	0.0000	0.0000	6.08	1113.54	54873.	49647.	.904809	53565.
.000164	.2493	0.0000	0.0000	0.0000	7.92	1318.84	57473.	51414.	.894657	55471.
.000178	.2862	0.0000	0.0000	0.0000	10.10	1528.76	59007.	51975.	.880884	56476.
.000192	.3243	0.0000	0.0000	0.0000	12.62	1738.75	59405.	51509.	.867078	55673.
.000206	.3631	0.0000	0.0000	0.0000	15.48	1944.89	58880.	50252.	.853468	54217.
.000221	.4027	0.0000	0.0000	0.0000	18.68	2144.55	57666.	48445.	.840111	52268.
.000236	.4423	0.0000	0.0000	0.0000	22.22	2335.75	55981.	46182.	.825110	49848.
.000251	.4818	0.0000	0.0000	0.0000	26.08	2517.48	54009.	43991.	.814511	47462.
.000266	.5212	0.0000	0.0000	0.0000	30.25	2689.31	51890.	41434.	.798235	44819.
.000281	.5603	0.0000	0.0000	0.0000	34.72	2851.21	49726.	39315.	.790963	42417.
.000297	.5990	0.0000	0.0000	0.0000	39.48	3003.47	47586.	37086.	.779036	40012.
.000312	.6373	0.0000	0.0000	0.0000	44.52	3146.52	45514.	34978.	.768851	37738.
.000328	.6752	0.0000	0.0000	0.0000	49.82	3280.91	43537.	33005.	.758084	35609.
.000344	.7126	0.0000	0.0000	0.0000	55.37	3407.22	41669.	31170.	.748055	33630.
.000360	.7494	0.0000	0.0000	0.0000	61.16	3526.03	39916.	29473.	.738390	31799.
.000377	.7856	0.0000	0.0000	0.0000	67.18	3637.90	38278.	27908.	.729088	30110.
.000393	.8213	0.0000	0.0000	0.0000	73.43	3743.38	36751.	26464.	.720111	28553.
.000409	.8537	0.0000	0.0000	0.0000	79.89	3845.70	35067.	24985.	.712511	26957.
.000424	.8701	0.0000	0.0000	0.0000	84.65	3944.78	32737.	23107.	.705859	25428.
.000440	.8850	0.0000	0.0000	0.0000	93.40	4044.83	30603.	21577.	.705108	23980.
.000455	.8984	0.0000	0.0000	0.0000	100.43	4137.51	28648.	20109.	.701193	21495.
.000470	.9104	0.0000	0.0000	0.0000	107.62	4222.40	26858.	18776.	.699010	20258.
.000485	.9217	0.0000	0.0000	0.0000	114.97	4302.04	25217.	17645.	.699456	19051.
.000500	.9317	0.0000	0.0000	0.0000	122.47	4376.89	23713.	16463.	.694427	17942.
.000515	.9407	0.0000	0.0000	0.0000	130.10	4447.38	22332.	15458.	.692227	16878.
.000530	.9489	0.0000	0.0000	0.0000	137.86	4513.89	21062.	14541.	.690437	15888.
.000545	.9563	0.0000	0.0000	0.0000	145.75	4576.75	19892.	13700.	.688872	14981.
.000560	.9629	0.0000	0.0000	0.0000	153.75	4636.27	18814.	12930.	.687523	13950.
.000575	.9689	0.0000	0.0000	0.0000	161.86	4692.72	17818.	12221.	.686289	13186.
.000590	.9743	0.0000	0.0000	0.0000	170.07	4746.33	16897.	11569.	.684469	12482.
.000605	.9792	0.0000	0.0000	0.0000	178.38	4797.34	16043.	10967.	.683862	11833.
.000620	.9835	0.0000	0.0000	0.0000	186.78	4845.93	15250.	10411.	.682866	11232.
.000622	.9841	0.0000	0.0000	0.0000	188.00	4850.00	15144.	10337.	.682953	11152.

MAX.CHAMBER PRESSURE,PSI 59407.
MAX.PROJECTILE BASE PRESSURE,PSI 51976.
MUZZLE VELOCITY,FPS 4850.
MAX.ACCELERATION,G 56078.

Section K-12


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000112122  0  102 0 0 0                                    00        0.        0.
PROJECTILE  8 INCH  M106
   .010    .600    .800    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   2.000   2.500   3.000  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
   .135    .135    .144    .177    .227    .335    .361    .384    .449    .328
   .313    .288    .263    .228    .200  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
  30.000  2500.000   200.000     7.990     0.000     0.000     0.000
   0.000     0.000     0.000   786.500     4.130     2.000     0.000
   0.000     7.000    10.000  6000.000     0.000     1.000     0.000
   1.000
   0.000     .005     .005     .005     0.000   1.000   1.000  40.000
     0.0      0.0      0.0      0.0       0.0    20.0
000112122  0  102 0 0 0                                    00        0.        0.
PROJECTILE  8 INCH  M106
   .010    .600    .800    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   2.000   2.500   3.000  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
   .142    .142    .147    .186    .238    .352    .379    .378    .366    .344
   .329    .302    .274    .239    .210   0.000   0.000   0.000   0.000   0.000
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
  30.000  2500.000   200.000     7.990     0.000     0.000     0.000
   0.000     0.000     0.000   786.500     4.130     2.000     0.000
   0.000     7.000    10.000  6000.000     0.000     1.000     0.000
   1.000
   0.000     .005     .005     .005     0.000   1.000   1.000  40.000
     0.0      0.0      0.0      0.0       0.0    20.0
000112122  0  102 0 0 0                                    00        0.        0.
PROJECTILE  8 INCH  M106
   .010    .600    .800    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   2.000   2.500   3.000  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
   .135    .135    .144    .177    .227    .335    .361    .384    .449    .328
   .313    .288    .263    .228    .200  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
  32.000  2500.000   200.000     7.990     0.000     0.000     0.000
   0.000     0.000     0.000   786.500     4.130     2.000     0.000
   0.000     7.000    10.000  6000.000     0.000     1.000     0.000
   1.000
   0.000     .005     .005     .005     0.000   1.000   1.000  40.000
     0.0      0.0      0.0      0.0       0.0    20.0
000112122  0  102 0 0 0                                    00        0.        0.
PROJECTILE  8 INCH  M106
   .010    .600    .800    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   2.000   2.500   3.000  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
   .135    .135    .144    .177    .227    .335    .361    .384    .449    .328
   .313    .288    .263    .228    .200  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
  30.000  2550.000   200.000     7.990     0.000     0.000     0.000
   0.000     0.000     0.000   786.500     4.130     2.000     0.000
   0.000     7.000    10.000  6000.000     0.000     1.000     0.000
   1.000
   0.000     .005     .005     .005     0.000   1.000   1.000  40.000
     0.0      0.0      0.0      0.0       0.0    20.0
```

AEROBALLISTICS BRANCH
TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE 8 INCH M106

NFIT	KDCON	NTHRST	KT	M	NUNIT	JN	NJR	IAUTO	ISPIN	IA	NATWS	NORM
0001	1	2	1	7	7	0	1	0	2	0	0	0

CORR TABLE FOR PHASES TWO AND FOUR

MACH	.810	.600	.800	.900	.950	1.000	1.050	1.100	1.200	1.350
	1.500	1.750	2.000	2.500	3.000	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
CM	.134	.135	.140	.177	.227	.335	.361	.360	.349	.328
	.313	.288	.263	.228	.200	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

THDEG	V	WGT	DIA	X	Y	T
78.000	2500.000	200.000	7.990	0.000	0.000	0.000

THRUST	DOTM	BWGT	THR2	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	786.5000	4.130	2.0	0.000

TTW(1)	TTW(2)	TTW(3)	TTW(4)	CKD	FACT	YE
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	40.000

EPIN	TK(1)	TK(2)	TK(3)	TK(4)	TWIST	INITIAL TURNS (REVS)
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

AERODALISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

PRE-FLIGHT OF MAIN STAGE

TIME	RANGE X-DERIV SPIN RATE TOTAL TURNS	ALTITUDE Y-DERIV GYRO STAR	VELOCITY V-DERIV DYNAMIC	THETA TH-DERIV RECIPCAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MACH THRUST WEIGHT	CD DRAG DRAG/MASS	YAW LEND YAW FREQ SPIN RPS	SLANT DIST TEMPERATURE DENSITY
0.000	0.000 650.611 1170.472 -0.000	0.000 381.000 XXXXXX	762.000 -36.132 XXXXX	30.000 -.639 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	2.2393 0.0000 200.000	.2463 636.887 31.229	XXXXXX XXXXXX 187.735	0.000 288.160 2.3769E-03
48.000	16307.674 284.149 1170.472 7500.187	3321.496 -125.368 XXXXXX	910.576 .542 XXXXX	-23.887 -1.655 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9489 0.0000 200.000	.2259 69.686 7.417	XXXXXX XXXXXX 187.735	19638.377 266.582 1.7066E-03
57.423	20727.038 284.149 1170.472 10760.288	0.000 -125.368 XXXXXX	929.829 .542 XXXXX	-48.185 -1.655 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9693 0.0000 200.000	.2686 130.144 20.937	XXXXXX XXXXXX 187.735	20727.038 288.160 2.3769E-03

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AEROBALLISTICS BRANCH

PROJECTILE 8 INCH M106

SUMMARY OF TRAJECTORIES

NJW	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT DGT	INIT SPIN FINAL SPIN FINAL DGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO PARAMETER
1	0.000	38.000	1179.572	0.000	0.000	0.000	782.000
	57.429	-48.185	1179.572	0.000	26727.038	0.000	329.829
	40.000	200.000	200.000	0.000	16303.474	3321.498	7.990

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE 8 INCH M106

NEXT	KDCON	NTHRST	KT	M	NUNIT	JN	NJR	IAUTO	ISPIN	IA	NATMS	NROM
CARD	1	2	1	2	2	0	1	0	2	0	0	0

CD&K TABLE FOR PHASES TWO AND FOUR

MACH	.010	.600	.800	.900	.950	1.000	1.050	1.100	1.200	1.350
	1.500	1.750	2.000	2.500	3.000	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
CD	.142	.142	.147	.186	.238	.352	.379	.378	.354	.344
	.329	.302	.276	.239	.210	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

THDEG	V	WGT	DIA	X	Y	T
90.000	2500.000	200.000	7.990	0.000	0.000	0.000

THRUST	DOTH	PWGT	THR2	DOTH2	CANCEL	BIAS
0.0000	0.000	0.000	786.5000	6.130	2.0	0.000

TIM(1)	TIM(2)	TIM(3)	TIM(4)	CKD	FACT	VF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	40.000

SPIN	TK(1)	TK(2)	TK(3)	TK(4)	TWIST	INITIAL TURNS (REVS)
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

FREE-FLIGHT OF MAIN STAGE

TYME	RANGE X-DERIV SPIN RATE TOTAL TIMES	ALTITUDE Y-DERIV GYRO STAB	VELOCITY V-DERIV DYNAMIC	THETA TH-DERIV RECIPCAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MACH THRUST WEIGHT	CD DRAG TRACTRESS	YAW FREQ YAW FREQ SPIN RPS	SLANT RIST TEMPERATURE DENSITY
0.000	0.000 659.011 1170.572 -0.000	0.000 341.000 XXXXXX	762.000 -37.659 XXXXX	90.000 -.639 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	2.2393 0.0000 200.000	.2583 669.034 32.756	XXXXXX XXXXXX 187.735	0.000 288.160 2.3769E-03
40.000	18026.184 270.261 1170.572 7500.187	3148.788 -128.882 XXXXXX	307.387 .714 XXXXX	-28.774 -1.659 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9382 0.0000 200.000	.2297 69.239 3.395	XXXXXX XXXXXX 187.735	16339.434 267.456 1.7306E-03
56.660	20205.945 270.261 1170.572 18637.148	0.000 -128.882 XXXXXX	337.992 .714 XXXXX	-48.136 -1.659 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9639 0.0000 200.000	.2696 129.183 20.782	XXXXXX XXXXXX 187.735	20205.945 288.160 2.3769E-03

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AERODYNAMICS BRANCH

PROJECTILE 8 INCH MIOR

SUMMARY OF TRAJECTORIES

NUM	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT DGT	INIT SPIN FINAL SPIN FINAL DGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO DIAMETER
1	0.000 54.464 40.000	30.000 -48.136 200.000	1170.572 1170.572 200.000	0.000 0.000 0.000	0.000 26205.945 18026.184	0.000 0.000 7186.762	782.000 327.992 7.990

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE A INCH M106

NEXT	KDCON	NTHRST	KT	N	NUNIT	JN	NJR	IAUTO	ISPIN	TA	NATMS	NORM
0001	1	2	1	2	2	0	1	0	2	0	0	0

CODE TABLE FOR PHASES TWO AND FOUR

MACH	.810	.600	.800	.900	.950	1.000	1.050	1.100	1.200	1.350
	1.500	1.750	2.000	2.500	3.000	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
CD	.135	.135	.140	.177	.227	.335	.361	.360	.349	.328
	.313	.288	.262	.228	.200	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

THDEG	V	BRT	DIA	X	Y	T
72.000	2500.000	200.000	7.990	0.000	0.000	0.000

THRUST	DOTH	BWGT	THR2	DOTH2	CANCEL	BIAS
0.0000	0.000	0.000	788.5000	4.130	2.0	0.000

TIM(1)	TIM(2)	TIM(3)	TIM(4)	CKD	FACT	YF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	40.000

SPIN	TK(1)	TK(2)	TK(3)	TK(4)	TWIST	INITIAL TURNS (REVS)
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

PREFLIGHT OF MAIN STAGE

TIME	RANGE X-DERIV SPIN RATE TOTAL TERMS	ALTITUDE Y-DERIV GYRO STAB	VELOCITY V-DERIV DYNAMIC	THETA TH-DERIV RECIPCAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MACH THRUST WEIGHT	CD DRAG DRAG/MASS	YAW FREQ YAW FREQ SPIN RPS	PLANET RAD TEMPERATURE DENSITY
0.000	0.000	0.000	762.000	32.000	XXXXX	XXXXX	2.2393	.2461	XXXXXX	0.000
	644.219	443.760	-36.425	-.625	XXXXX	XXXXX	0.0000	632.887	XXXXXX	288.150
	1170.572	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	31.229	187.735	2.3769E-03
	-0.000									
40.000	18116.884	3927.388	307.962	-21.885	XXXXX	XXXXX	.9479	.2285	XXXXXX	16987.489
	288.749	-114.786	.517	-1.693	XXXXX	XXXXX	0.0000	64.015	XXXXXX	262.648
	1170.572	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	7.139	187.735	1.6020E-03
	7500.387									
60.452	21258.120	0.000	331.522	-50.321	XXXXX	XXXXX	.9742	.2793	XXXXXX	21258.120
	288.749	-114.786	.517	-1.693	XXXXX	XXXXX	0.0000	136.788	XXXXXX	288.150
	1170.572	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	21.998	187.735	2.3769E-03
	11340.636									

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AERODYNAMICS BRANCH

[illegible] 8 INCH MIOR

SUMMARY OF TRAJECTORIES

NJB	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT RGT	INIT SPIN FINAL SPIN FINAL RGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO DIAMETER
1	0.000	32.000	1179.572	0.000	0.000	0.000	782.000
	66.452	-50.321	1179.572	0.000	21258.120	0.000	331.522
	46.000	200.000	700.000	0.000	16115.847	1927.348	7.990

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE 8 INCH M106

	NEXT PART	KOCON	NTHRST	KT	M	NUMTT	JN	NJR	IAUTO	ISPIN	IA	NATMS	NORM
	1	2	1	2	3	0	1	0	2	0	0	0	

CDAK TABLE FOR PHASES TWO AND FOUR

MACH	.010	.600	.800	.950	.950	1.000	1.050	1.100	1.200	1.350
	1.500	1.750	2.000	2.500	3.000	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
CD	.135	.135	.140	.177	.227	.335	.361	.365	.385	.329
	.317	.243	.243	.220	.200	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

THDEG	V	WGT	RTA	X	Y	T
30.000	2550.000	200.000	7.99	0.000	0.000	0.000

THRUST	DOTM	RWGT	THR2	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	THR.5000	4.130	2.0	0.000

TIM(1)	TIM(2)	TIM(3)	TIM(4)	CWD	FACT	VF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	0.000

SPIN	TR(1)	TR(2)	TR(3)	TR(4)	TWIST	INITIAL TIPANG	TREVST
0.000	0.000	0.000	0.000	0.000	20.000		-0.000

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

PERFECTLY OF MAIN STAGE

TIME	RANGE X-DERIV SPIN RATE TOTAL TURNS	ALTITUDE Y-DERIV GYRO STAB	VELOCITY V-DERIV DYNAMIC	THETA TH-DERIV RECIPOCAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MACH THRUST WEIGHT	CP DRAG DRAG/MASS	YAW DMPG YAW FREQ SPIN RPS	SLANT DIST TEMPERATURE DENSITY
0.000	0.000 677.118 1203.169 -8.000	0.000 388.620 XXXXXX	777.240 -36.980 XXXXX	30.000 -.626 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	2.2440 0.0000 200.000	.2431 654.181 32.077	XXXXXX XXXXXX 191.489	0.000 288.160 2.3769E-03
40.000	16955.497 284.538 1203.169 7659.674	39481.531 -121.793 XXXXXX	311.348 .342 XXXXX	-23.028 -1.661 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.4933 0.0000 200.000	.2342 71.269 1.495	XXXXXX XXXXXX 191.489	16951.485 265.413 1.6750E-03
58.379	21256.497 284.538 1203.169 11178.457	0.000 -121.793 XXXXXX	330.345 .342 XXXXX	-48.709 -1.661 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9708 0.0000 200.000	.2719 132.185 21.258	XXXXXX XXXXXX 191.489	21256.497 288.160 2.3769E-03

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AEROBALLISTICS BRANCH

PROJECTILE 8 INCH WIDE

SUMMARY OF TRAJECTORIES

NUM	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT BGT	INIT SPIN FINAL SPIN FINAL BGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO ATTEMPTED
1	0.000 58.379 40.000	30.000 -48.709 200.000	1203.163 1203.163 200.000	0.000 0.000 0.000	0.000 21256.497 16584.497	0.000 0.000 7501.531	777.240 330.345 7.990

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AEROBALLISTICS BRANCH
TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE 8 INCH M106

NEXT	KDCOK	NTHRST	KT	M	NUMIT	JN	NJR	IAUTO	ISPIN	TA	NATMS	NORM
BAST	1	2	1	3	2	8	1	0	7	0	8	0

DRAG TABLE FOR PHASES TWO AND FOUR

MACH	.010	.600	.800	.900	.950	1.000	1.050	1.100	1.200	1.350
	1.500	1.750	2.000	2.500	3.000	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
CD	.135	.135	.140	.177	.227	.315	.141	.160	.345	.428
	.313	.288	.263	.228	.200	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

TIMER	V	WGT	DIA	X	Y	Z
20.000	2700.000	200.000	7.990	0.000	0.000	0.000

THRUST	DOTW	RWGT	THR2	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	786.5000	4.130	2.0	0.000

TIM(1)	TIM(2)	TIM(3)	TIM(4)	CRD	FACT	VF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	40.000

SPIN	TK(1)	TK(2)	TK(3)	TK(4)	TWIST	INITIAL TURNS (REVS)
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

PLUM-NINE SECTIONAL, TWO-STAGE ROCKET TRAJECTORY

POST-BOOST OF MAIN STAGE

TYME	RANGE X-DFSTN TOTAL TIME	ALTITUDE Y-DFSTN AVBA STAB	VELOCITY V-DFSTN FYNAMIC	T-DFTE TH-DFSTN DFCTDFAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRF FREQ	MACH THRUST WEIGHT	CD DRAG RHO/MASS	YAW TERC YAW FREQ SPIN RPS	SLANT DIST TEMPERATURE DENSITY
0.000	0.000 6[illegible].763 18[illegible].284 -0.288	0.000 239.770 XXXXXX	701.060 -31.132 XXXXX	20.000 -.763 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	2.0601 0.0000 200.000	.2588 564.511 27.778	XXXXXX XXXXXX 172.716	0.000 288.160 2.3769E-03
18.003	15[illegible].835 6[illegible].763 18[illegible].284 4719.280	0.000 239.770 XXXXXX	714.062 -31.132 XXXXX	-31.531 -.763 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9387 0.0000 200.000	.2117 96.382 18.344	XXXXXX XXXXXX 172.716	15673.832 288.160 2.3769E-03

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AERONAUTICS RESEARCH

SUMMARY OF TRAJECTORIES

N ID	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT WGT	INIT SPIN FINAL SPIN FINAL WGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO MYRMETER
1	0.000 20.007 0.000	20.000 -33.531 200.000	1885.206 1885.206 200.000	0.000 0.000 0.000	0.000 15473.032 0.000	0.000 0.000 0.000	701.040 318.042 7.990

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DS
PROPERTYLE  A  IAC=  VIDE
 25   0   0   0   4   0        000 00
   7.8500    7.8500    7.8500     .2830    19.7000                PRODY1   1
   7.9800    7.9800    1.8000     .2830    29.3200                PRODY2   1
   7.9800    7.9800    4.0000     .2830    31.1200                PRODY3   1
   7.9900    7.9900     .7000     .2830    18.5000                PRODY4   1
   7.0000    7.0000     .4000     .2830    19.1000                PRODY5   1
   7.0100    7.0100     .1000     .2830    29.1200                PRODY6   1
   7.0100    7.0100     .1000     .2830    28.2200                PRODY7   1
   6.4700    6.4700    6.0000    -.2230    19.1000                IPODY1   0
   6.4800    6.4800    1.4700    -.2230    31.1100                IPODY2   0
   6.0700    5.5000    2.5000    -.2230    24.5000                IPODY3   0
   5.5000    6.0000    3.1100    -.2230    20.0000                IPODY7   0
   6.3000    6.0700    1.2000    -.2230    25.3000                IPODY4   0
   6.4700    6.3000    1.2000    -.2230    24.1000                IPODY5   0
   6.0000    6.0000     .1200    0.0000    35.0000                IPODY6   0
   1.4000    1.4000     .1000    0.0000     3.7500                PRODYB   0
   1.4000    2.0000     .1000    0.0000     3.8500                PRODYC   0
   2.0000    1.4000     .1000    0.0000     3.9500                PRODYD   0
   1.4000    2.0000     .1000    0.0000     4.0500                PRODYE   0
   2.0000    1.4000     .1000    0.0000     4.1500                PRODYF   0
   1.4000    2.0000     .1000    0.0000     4.2500                PRODYG   0
   2.0000    1.4000     .1000    0.0000     4.3500                PRODYH   0
   1.4000    2.0000     .1000    0.0000     4.4500                PRODYI   0
   2.0000    1.4000     .1000    0.0000     4.5500                PRODYJ   0
   1.4000    2.0000     .1000    0.0000     4.6500                PRODYK   0
   2.0000    1.4000     .1000    0.0000     4.7500                PRODYL   0
   1.4000    1.4000    1.1500     .0400     4.8500                PRODYM   0
   8.9500    8.1400    1.8000     .2830    27.1200                OPROTA   1
   8.0500    8.0000     .2000     .2830    29.1200                OPROTB   1
   8.1400    8.1400     .1500     .2830    28.3200                OPROTC   1
   8.1400    8.2800     .2000     .2830    28.4700                OPROTD   1
   8.2800    8.2800     .1000     .2830    28.4700                OPROTE   1
   7.9100    7.9100     .1500     .2830    29.7700                OPROTF   1
   8.1200    8.1200     .0800     .2830    28.9200                OPROTG   1
   8.1200    7.9900     .1200     .2830    29.0000                OPROTH   1
   7.5300    7.5300    2.8000    -0.0000    27.1200                IPROTA   0
 -18.9000   60.0000   14.3500     .2830     3.7500    64.1000 OOGIVE   1
 -17.0000   60.0000   13.2500    -.2230     4.8500    63.4000 IOGIVE   0
 -18.5000   60.0000    3.7500     .1000     0.0000    63.0000 FOGIVE   1
  -0.0000   -1.2500    1.8000    -.2230    39.5200     1.0000 ICIPVE   0
ENDDATASET
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Section K-15

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000112122  0  102 0 0 0                                    00        0.        0.
PROJECTILE  A IACH  W10A
   .010    .600    .900    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   2.000   2.500   3.000  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
   .145    .135    .143    .177    .227    .295    .361    .365    .349    .328
   .313    .288    .263    .228    .200  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
  30.000 2500.000  200.000    7.990    0.000    0.000    0.000
   0.000    0.000    0.000  786.500    4.130    2.000    0.000
   0.000    7.000   10.000 6000.000    0.000    1.000    0.000
   1.000
   0.000    .005    .005    .005   0.000   1.000   1.000  40.000
     0.0     0.0     0.0     0.0     0.0     0.0    20.0
000112122  0  102 0 0 0                                    00        0.        0.
PROJECTILE  A IACH  W10A
   .010    .600    .900    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   2.000   2.500   3.000  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
   .142    .142    .147    .186    .238    .362    .379    .378    .366    .344
   .329    .302    .274    .239    .210   0.000   0.000   0.000   0.000   0.000
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
  30.000 2500.000  200.000    7.990    0.000    0.000    0.000
   0.000    0.000    0.000  786.500    4.130    2.000    0.000
   0.000    7.000   10.000 6000.000    0.000    1.000    0.000
   1.000
   0.000    .005    .005    .005   0.000   1.000   1.000  40.000
     0.0     0.0     0.0     0.0     0.0     0.0    20.0
000112122  0  102 0 0 0                                    00        0.        0.
PROJECTILE  A IACH  W10A
   .010    .600    .900    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   2.000   2.500   3.000  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
   .135    .135    .143    .177    .227    .295    .361    .365    .349    .328
   .313    .288    .263    .228    .200  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
  32.000 2500.000  200.000    7.990    0.000    0.000    0.000
   0.000    0.000    0.000  786.500    4.130    2.000    0.000
   0.000    7.000   10.000 6000.000    0.000    1.000    0.000
   1.000
   0.000    .005    .005    .005   0.000   1.000   1.000  40.000
     0.0     0.0     0.0     0.0     0.0     0.0    20.0
000112122  0  102 0 0 0                                    00        0.        0.
PROJECTILE  A IACH  W10A
   .010    .600    .900    .900    .950   1.000   1.050   1.100   1.200   1.350
  1.500   1.750   2.000   2.500   3.000  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
   .145    .135    .143    .177    .227    .295    .361    .365    .349    .328
   .313    .288    .263    .228    .200  -0.000  -0.000  -0.000  -0.000  -0.000
 -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000  -0.000
  30.000 2550.000  200.000    7.990    0.000    0.000    0.000
   0.000    0.000    0.000  786.500    4.130    2.000    0.000
   0.000    7.000   10.000 6000.000    0.000    1.000    0.000
   1.000
   0.000    .005    .005    .005   0.000   1.000   1.000  40.000
     0.0     0.0     0.0     0.0     0.0     0.0    20.0
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AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE 8 INCH MIRA

NEXT	KPCON	NTHRST	KT	M	NUKTT	JN	KJR	IAUTO	ISPIN	IA	NATMS	NORM
KASE	1	2	1	2	3	0	1	0	2	0	0	0

CORR TABLE END PHASES TWO AND FOUR

MACH	.910	.600	.800	.900	.950	1.000	1.050	1.100	1.200	1.350
	1.500	1.750	2.000	2.500	3.000	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
CD	.135	.135	.140	.177	.227	.335	.341	.344	.345	.328
	.313	.288	.247	.228	.200	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

THDEG	V	WGT	CTA	X	Y	T
30.000	2500.000	200.000	7.990	0.000	0.000	0.000

THRLST	DOTM	RWGT	THR2	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	784.5000	4.130	2.0	0.000

TTM(1)	TTM(2)	TTM(3)	TTM(4)	CKA	FACT	VF
0.020	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
.005	.005	.005	.005	0.000	1.000	1.000	40.000

CDIN	YW(1)	YW(3)	YR(3)	YR(6)	TWTST	INITIAL TURNS TREVST
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

FREE-FLIGHT OF MAIN STAGE

TIME	RANGE X-DERIV SPIN RATE TOTAL TURNS	ALTITUDE Y-DERIV AERO STAB	VELOCITY V-DERIV DYNAMIC	THETA TH-DERIV RECTORAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MACH THRUST WEIGHT	CD DRAG PROP/MASS	YAW TERM YAW FREQ SPIN RPS	SLANT DIST TEMPERATURE DENSITY
0.000	0.000	0.000	760.000	90.000	XXXXX	XXXXX	2.2393	.2663	XXXXXX	0.000
	859.011	381.000	-34.132	-.639	XXXXX	XXXXX	0.0000	436.887	XXXXXX	288.160
	1170.572	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	31.229	187.735	2.7769E-03
	-0.000									
40.000	18388.474	3391.698	918.576	-23.887	XXXXX	XXXXX	.9689	.2256	XXXXXX	16838.777
	284.140	-125.368	.542	-1.655	XXXXX	XXXXX	0.0000	69.686	XXXXXX	266.582
	1170.572	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	7.417	187.735	1.9868E-03
	7500.387									
57.423	20727.038	0.000	329.829	-48.185	XXXXX	XXXXX	.9693	.2686	XXXXXX	20727.038
	284.140	-125.368	.542	-1.655	XXXXX	XXXXX	0.0000	130.148	XXXXXX	288.160
	1170.572	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	20.937	187.735	2.7769E-03
	10788.388									

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AERONAUTICS RESEARCH

[illegible]

SUMMARY OF TRAJECTORIES

NJP	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT WGT	INIT SPIN FINAL SPIN FINAL WGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO MACHETER
1	0.000 57.423 40.000	90.000 -48.185 200.000	1170.572 1170.572 200.000	0.000 0.000 0.000	0.000 20727.038 14303.474	0.000 0.000 4121.494	742.000 329.829 7.000

AEROBALLISTICS BRANCH
TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE A INCH MIRA

AERT	ADCON	NTHRST	NT	M	NUART	JN	NJR	IAUTO	ISPIN	IA	NATMS	NORM
0001	1	2	1	2	3	0	1	4	2	0	0	0

DRAG TABLE FOR PHASES TWO AND FOUR

MACH	.810	.600	.900	.900	.950	1.000	1.050	1.100	1.200	1.250
	1.500	1.750	2.000	2.500	3.000	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
CD	.142	.143	.143	.186	.238	.352	.339	.328	.322	.344
	.320	.302	.276	.239	.210	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

THREE	V	WGT	DIA	X	Y	T
30.000	2500.000	200.000	7.990	0.000	0.000	0.000

THRUST	DOTM	PWGT	THR2	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	785.5000	4.130	2.0	0.000

TIM(1)	TIM(2)	TIM(3)	TIM(4)	CRD	FACT	YF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	40.000

SPIA	TK(1)	TK(2)	TK(3)	TK(4)	TWIST	INITIAL TURNS (REVS)
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

PREFLIGHT OF MAIN STAGE

TIME	RANGE X-DERIV SPIN RATE TOTAL TURNS	ALTITUDE Y-DERIV GYRO GYAR	VELOCITY V-DERIV DYNAMIC	THETA TH-DERIV RECIPOCAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MACH THRUST WEIGHT	CD DRAG PROP/MASS	YAW LENG YAW FREQ SPIN RPS	SLANT DIST TEMPERATURE DENSITY
0.000	0.000 660.011 1170.673 -0.000	0.000 301.000 XXXXXX	763.000 -37.659 XXXXX	30.000 -.639 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	2.2393 0.0000 200.000	.2583 668.034 32.756	XXXXXX XXXXXX 187.735	0.000 288.160 2.3769E-03
40.000	16824.164 270.261 1170.673 7590.387	1186.768 -138.882 XXXXXX	487.567 .714 XXXXX	-36.774 -1.659 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9782 0.0000 200.000	.2257 69.239 3.395	XXXXXX XXXXXX 187.735	16339.934 267.456 1.7386E-03
56.660	20205.945 270.261 1170.673 10677.140	0.000 -138.882 XXXXXX	327.992 .714 XXXXX	-48.136 -1.659 XXXXX	XXXXX XXXXX XXXXX	XXXXX XXXXX XXXXX	.9639 0.0000 200.000	.2696 129.187 20.782	XXXXXX XXXXXX 187.735	20205.945 288.160 2.3769E-03

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AEROBALLISTICS BRANCH

PROJECTILE 8 INCH MINA

SUMMARY OF TRAJECTORIES

NUM	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT WGT	INIT SPIN FINAL SPIN FINAL WGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO ATMOSTEM
1	0.000	30.000	1179.572	0.000	0.000	0.000	782.000
	54.460	-48.174	1179.572	0.000	20205.945	0.000	327.992
	40.000	200.000	200.000	0.000	16026.164	5184.768	7.990

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE 8 INCH M106

NEXT	KOCOR	NTHRST	KT	M	NUMTT	JN	NJR	IAUTO	ISPIN	IA	NATMS	KCRM
0001	1	2	1	5	5	8	1	0	2	0	0	0

DRAG TABLE FOR PHASES TWO AND FOUR

MACH	.810	.600	.800	.900	.950	1.000	1.050	1.100	1.200	1.350
	1.500	1.750	2.000	2.500	3.000	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
CD	.135	.145	.160	.177	.227	.335	.341	.368	.368	.428
	.313	.288	.243	.228	.200	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

THREF	V	WGT	DIA	X	Y	Y
32.000	2500.000	200.000	7.990	0.000	0.000	0.000

THRUST	DOTM	RWGT	THR2	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	96.5000	4.130	2.0	0.000

TIM(1)	TIM(2)	TIM(3)	TIM(4)	CRD	FACT	VF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	40.000

SPIN	YK(1)	YK(2)	YK(3)	YK(4)	TWIST	INITIAL TURNS (REVS)
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

AEROBALLISTICS BRANCH

TWO-ATMOSPHERIC, TWO-STAGE ROCKET TRAJECTORY

FREE-FLIGHT OF MAIN STAGE

TIME	RANGE X-DERIV SPIN RATE TOTAL TURNS	ALTITUDE Y-DERIV CORE STAR	VELOCITY V-DERIV DYNAMIC	THETA TH-DERIV RECIPCAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MACH THRUST WEIGHT	CD DRAG DRAG/MASS	YAW TEND YAW FREQ SPIN RPS	SLANT DIST TEMPERATURE DENSITY
0.000	0.000	0.000	762.000	32.000	XXXXX	XXXXX	2.2393	.2663	XXXXXX	0.000
	444.213	403.799	-34.625	-.625	XXXXX	XXXXX	0.0000	634.887	XXXXXX	288.160
	1170.672	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	21.229	187.735	2.3769E-03
	-0.000									
40.000	19316.884	3997.188	707.962	-21.885	XXXXX	XXXXX	.9479	.2269	XXXXXX	16587.689
	288.760	-114.786	.517	-1.693	XXXXX	XXXXX	0.0000	64.015	XXXXXX	242.648
	1170.672	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	7.139	187.735	1.6020E-03
	7570.287									
60.652	21258.120	0.000	731.522	-50.321	XXXXX	XXXXX	.9742	.2793	XXXXXX	21258.120
	288.760	-114.786	.517	-1.693	XXXXX	XXXXX	0.0000	134.745	XXXXXX	288.160
	1170.672	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	21.998	187.735	2.3769E-03
	11348.934									

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AEROBALLISTICS BRANCH

PROJECTILE M INCH MINE

SUMMARY OF TRAJECTORIES

NJB	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT WGT	INIT SPIN FINAL SPIN FINAL WGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO DIAMETER
1	0.000 60.452 40.000	32.000 -50.121 200.000	1170.572 1170.572 200.000	0.000 0.000 0.000	0.000 21258.120 14115.841	0.000 0.000 1927.388	762.000 331.522 7.990

AEROBALLISTICS BRANCH
TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

THE FOLLOWING IS INPUT DATA FOR TRAJECTORY NO. 1

PROJECTILE 8 INCH M106

NEXT	KDCOK	NTMRST	KT	M	NUMTT	JN	NJR	IAUTO	ISPIN	IA	NATMS	NCRM
0001	1	2	1	2	2	0	1	0	2	0	0	0

DRAG TABLE FOR PHASES TWO AND FOUR

MACH	.010	.600	.800	.900	.950	1.000	1.050	1.100	1.200	1.250
	1.500	1.750	2.000	2.500	3.000	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
CD	.136	.136	.140	.177	.227	.345	.341	.340	.345	.328
	.313	.288	.263	.228	.200	-0.000	-0.000	-0.000	-0.000	-0.000
	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

THREE	V	WGT	DIA	X	Y	Y
30.000	2550.000	200.000	7.990	0.000	0.000	0.000

THRUST	DOTM	RWGT	THR2	DOTM2	CANCEL	BIAS
0.0000	0.000	0.000	284.5000	4.130	2.0	0.000

TTM(1)	TTM(2)	TTM(3)	TTM(4)	CKD	FACT	VF
0.000	7.000	10.000	6000.000	0.000	1.000	0.000

DELTT(1)	DELTT(2)	DELTT(3)	DELTT(4)	DWRT(1)	DWRT(2)	DWRT(3)	DWRT(4)
0.000	.005	.005	.005	0.000	1.000	1.000	40.000

SPIN	TK(1)	TK(2)	TK(3)	TK(4)	YWIST	INITIAL TURNS (REV)
0.000	0.000	0.000	0.000	0.000	20.000	-0.000

AEROBALLISTICS BRANCH

TWO-DIMENSIONAL, TWO-STAGE ROCKET TRAJECTORY

FREE-FLIGHT OF MAIN STAGE

TIME	RANGE X-DERIV SPIN RATE TOTAL TURNS	ALTITUDE Y-DERIV CORA STAB	VELOCITY V-DERIV DYNAMIC	THETA TH-DERIV RECIPCAL	NUTATION NU HALF NU FREQ	PRECESSION PRE HALF PRE FREQ	MACH THRUST WEIGHT	CM DRAG INRT/MASS	YAW FREQ YAW FREQ SPIN RPS	SLANT DIST SLANT DIST TEMPERATURE DENSITY
0.000	0.000	0.000	777.240	30.000	XXXXX	XXXXX	2.2940	.2431	XXXXXX	0.000
	672.118	388.620	-36.980	-.626	XXXXX	XXXXX	0.0000	654.181	XXXXXX	288.160
	1203.169	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	32.077	191.489	2.3769E-03
	-0.000									
40.000	16596.697	3581.591	311.384	-23.828	XXXXX	XXXXX	.9533	.2382	XXXXXX	10991.089
	284.538	-121.793	.342	-1.661	XXXXX	XXXXX	0.0000	71.269	XXXXXX	265.413
	1203.169	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	8.495	191.489	1.6750E-03
	7659.574									
58.379	21254.497	0.000	330.345	-48.709	XXXXX	XXXXX	.9708	.2719	XXXXXX	21256.497
	284.538	-121.793	.342	-1.661	XXXXX	XXXXX	0.0000	132.166	XXXXXX	288.160
	1203.169	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	200.000	21.258	191.489	2.3769E-03
	11178.957									

END OF TRAJECTORY NO. 1

ENGINEERING SCIENCE LABORATORY
AEROBALLISTICS BRANCH

PROJECTILE 4 INCH MINA

SUMMARY OF TRAJECTORIES

NJB	INIT TIME FINAL TIME MAX ALT TIME	INIT ANGLE FINAL ANGLE INIT WGT	INIT SPIN FINAL SPIN FINAL WGT	INIT GYRO FINAL GYRO MAX ALT GYRO	INIT RANGE FINAL RANGE MAX ALT RANGE	INIT ALT FINAL ALT MAX ALT	INIT VELO FINAL VELO DIAMETER
1	0.000 58.779 48.000	30.000 -48.700 200.000	1209.163 1209.163 200.000	0.000 0.000 0.000	0.000 21256.497 16585.493	0.000 0.000 3501.531	777.240 330.345 7.990

APPENDIX L

UNABBREVIATED OUTPUT AT THE TELETYPE

Unabbreviated Output at the Teletype

Normal usage of IPSSM at the teletype involves batching the job to a central computer site, where the full output can later be retrieved, and/or asking for an abbreviated set of results to be recallable at the same teletype terminal. At Picatinny Arsenal a routine DISPLAYOUTPUT is available to allow the full unabbreviated output of an IPSSM run to be examined at the teletype. Specific instructions follow.

Before typing IPSM at the start of the teletype run, enter:

ATTACH,DISPLAY,DISPLAYOUTPUT,CY=1,ID=MISDSEAD.

Then proceed normally, but when ready to batch your program, enter:

BATCH,JOB,INPUT,HERE.

A name will then be assigned to your job; wait until the job has executed and is in the output queue, then enter:

BATCH,(JOBNAME),LOCAL

DISPLAY,(JOBNAME)

The system response will be

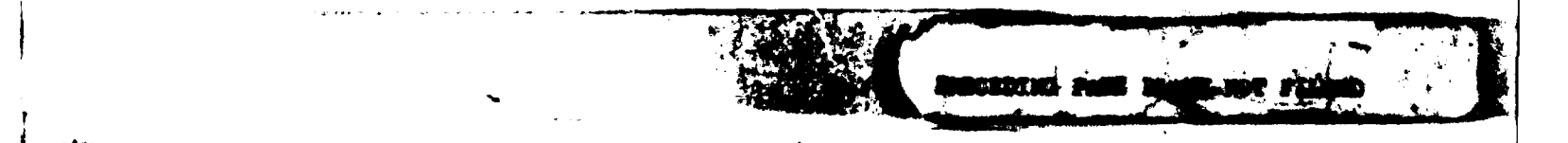
PAGE NUMBER = 1 TOTAL PAGES OF OUTPUT = N

PAGE NUMBER = --- (RIGHT JUSTIFIED)

The page number to be examined is now entered in right-justified format (i.e., the third page would be designated as 003).

Upon completion of examination at the teletype terminal, PAGE 999 is entered to terminate this routine. You may then logout or use the DISPOSE facility to send a permanent record of the unabbreviated results to batch terminal. To dispose your output to a specific terminal, enter the following statement:

DISPOSE,OUTPUT,(TERMINAL CODE)



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